BRIDGE AND BUILDING CONVENTION NUMBER

NOVEMBER, 1946

Railway Engineering and Maintenance

SO MANY ROADS FOR SO MANY YEARS HAVE PROTECTED SO MANY MILES OF TRACK WITH IMPROVED HIPOWERS THAT THEIR EFFICIENCY IS THOROUGHLY ESTABLISHED AND THEIR ECONOMY IS HIGHLY APPRECIATED.

IMPROVED HIPOWERS

IMPROVE TRACK

ATCHISON, TOPEKA & SANTA FE PHOTO

* Ellos mantienen los pernos de ataduras apretados - por mas tiempo!

***South Americans know Reliance Hy-Crome Spring Washers keep bolted fastenings tighter longer!**

● The illustration shows part of a shipment of rustproof Reliance Hy-Crome Double-Coil Spring Washers for use on a track fastening appliance on a South American railroad.

These double Hy-Crome Spring Washers can also be used on track bolts and meet the A.R.E.A. specification requirements.

All types of Reliance Hy-Crome Spring Washers have enduring reactive pressure which automatically compensates for looseness as a result of wear, especially under tough South American climatic conditions.

There is a type of Hy-Crome Spring Washer for every fastening problem that keeps bolted parts *tighter longer*.

Write for a copy of the folder of Reliance Hy-Crome Spring Washers for railroad track applications. It will help eliminate maintenance-of-way headaches.

Reliance **DOUBLE HY-CROME** *spring washers*

RELIANCE DIVISION
Office and plant MASSILLON, OHIO

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

EATON
EATON MANUFACTURING COMPANY

WHEREVER B+B MEN MEET THERE WILL BE TALK ABOUT *the best method to kill corrosion*

As maintenance men map new programs for the upkeep of railway structures, the outstanding record of NO-OX-ID as a positive rust preventive comes up for recognition.

For over a quarter century, railroads have supplied maintenance crews with NO-OX-ID and instructions to coat all metal structures where corrosion attack is very rapid and destructive. During all this time it has proved most dependable.

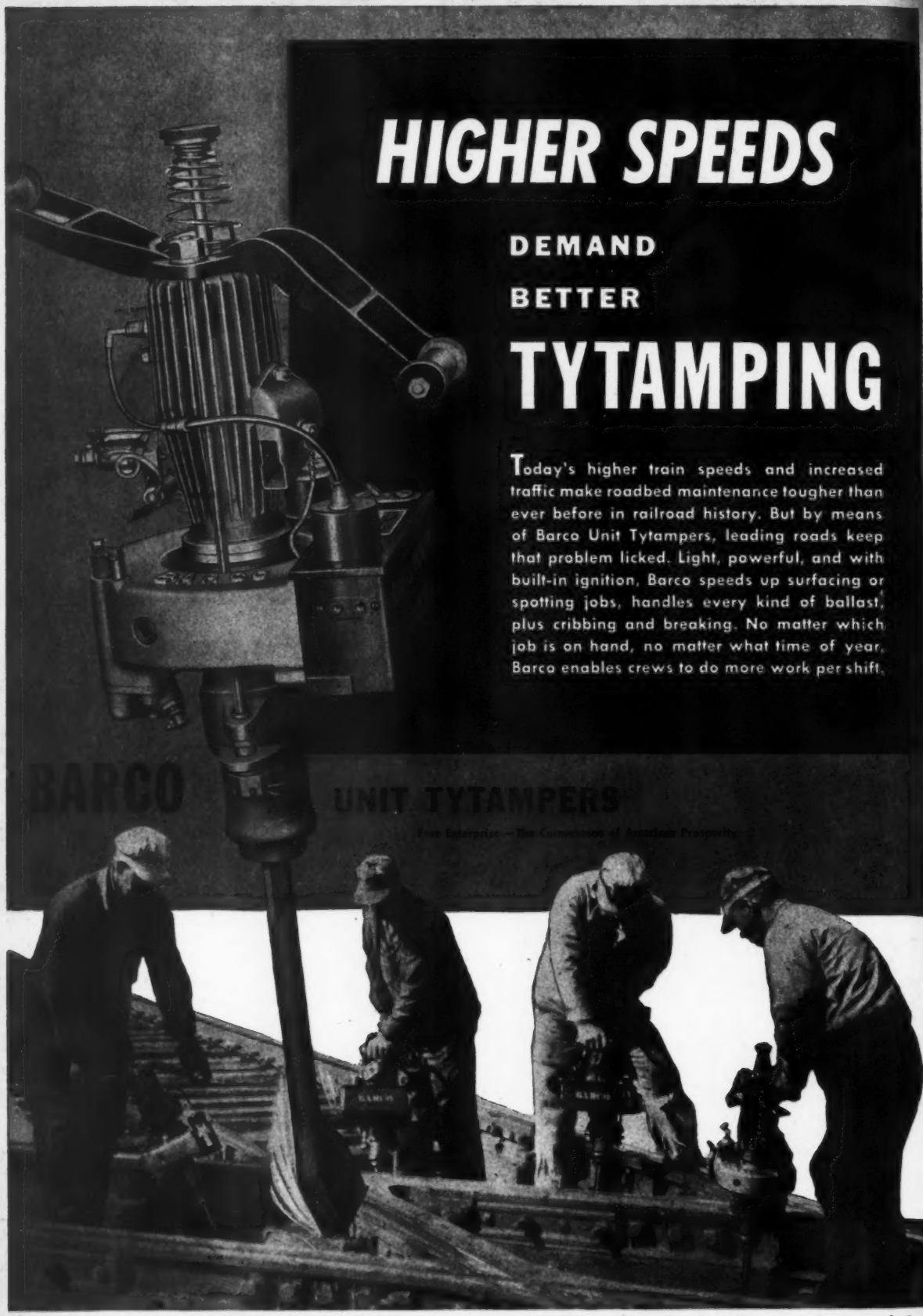
Railroad men find NO-OX-ID's action immediate . . . and lasting. It stops loss of metal where corrosion has already started; it keeps new metal rust resistant under the most severe conditions. Saves time . . . labor, as coatings can be applied directly over rusted surfaces, without extensive precleaning.

Specify NO-OX-ID and simplify the maintenance job on bridges and buildings. There are many consistencies available. Get the details . . . today.

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company
Dept. U, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00 for one year; $3.00 for two years. Single copies 50 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.


HIGHER SPEEDS
DEMAND
BETTER
TYTAMPING
Today's higher train speeds and increased traffic make roadbed maintenance tougher than ever before in railroad history. But by means of Barco Unit Tytampers, leading roads keep that problem licked. Light, powerful, and with built-in ignition, Barco speeds up surfacing or spotting jobs, handles every kind of ballast, plus cribbing and breaking. No matter which job is on hand, no matter what time of year, Barco enables crews to do more work per shift.
BARCO
UNIT TYTAMPERS

BARCO MANUFACTURING COMPANY, NOT INC., 1805 Winnemac Ave., Chicago 40, Ill. • In Canada: The Holden Co., Ltd., Montreal, Can.

Two First Aids
For Safer Tie

FIRST AID No. 1

Heavy hand tools are the work horses for railroad maintenance. With them America's husky, robust men do the tough jobs along the right of way. Not delicate tools for gentle men —but tough tools for strong men make up the Devil line. Made of selected, electric furnace Tool steel, and made under Warren's production control system, these Devil Tools give safer performance plus longer service. Select them first, for "Safety First."

FIRST AID No. 2

Warren Tool Corporation will furnish you with charts for the care of tools. These charts are Van Dyke prints and you can make as many copies from them as you wish. They make ideal, easy-to-use guides for tool maintenance. Use them too, for "Safety First."

★ ★ ★ ★ ★

Send us complete details as to where you would like to have us mail the prints.

DEVIL TOOLS

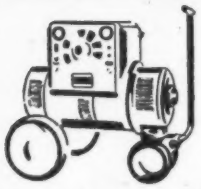
WARREN TOOL CORP. • WARREN, OHIO

GENERAL SALES OFFICES
105 W. Adams St., Chicago

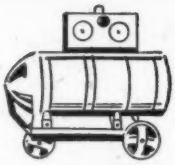
FACTORY: GRISWOLD ST.
WARREN, OHIO

HOW TO GET ARC WELDERS IN A HURRY!

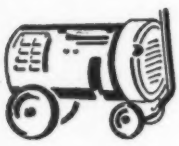
IT'S EASY FOR THE SMALL BUSINESSMAN TO GET THEM AT A SAVING.



Hobart—Standard models of this make available in large quantities and most ratings.



Lincoln—In all models and most ratings. Many in the popular 300—400 Ampere size.



Westinghouse—Portable models available in limited quantities.

Electrodes and Welding Rods—Millions of pounds available in all types and sizes.

Hundreds of arc welders are available to small businesses for immediate delivery. Some are unused. Some are used. All were made by well known manufacturers.

Now they are offered for sale at real bargain prices.

These are the type welders needed by garages, repair shops and maintenance shops. The large inventory includes welders of 200, 300 and 400 Ampere Rating, either DC or AC. They are located at various points throughout the country and may be inspected before purchase.

To obtain complete information on availability, location and condition of the equipment you want, fill out the coupon and send it to your nearest War Assets Administration Regional Office.

For full information clip and mail this coupon to:

War Assets Administration:
Please send me complete information on the availability, condition and location of the following types of equipment.

....Hobart Arc Welders
....Lincoln Arc Welders
....Westinghouse Arc Welders
....Electrodes and Welding Rods
Arc Welding Equipment AC.... DC....
Electric Motor Driven: Volts....Phase....Cycles....
Transformer Type: Volts....Phase....Cycles....

Name .....
Firm .....
Address .....State.....
City .....

All Arc Welders are subject to priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area and then to purchase the material offered herein.

EXPORTERS

The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

Where to ?

HERE'S a machine you can put on any job on or off the line almost at a moment's notice. It loads itself completely, erected on a standard flatcar, under its own power. On many jobs the line can be cleared for high-speed traffic, eliminating traffic delays and the time that must be wasted getting track type equipment out of the way.

Northwests go anywhere and handle off-the-line jobs like run-off ditches, bank trimming, new right-of-way or they will work from a car unloading rail or ballast or handling storeyard materials.

Easy conversion from Shovel to Crane or Dragline by simply changing booms assures equipment for any material handling or excavating problem. It's a real railway man's machine — proved on the leading railroads of the country.

NORTHWEST ENGINEERING CO.
1713 Steger Bldg., 28 E. Jackson Blvd.
Chicago 4, Illinois

ALL-PURPOSE RAILROAD MACHINE

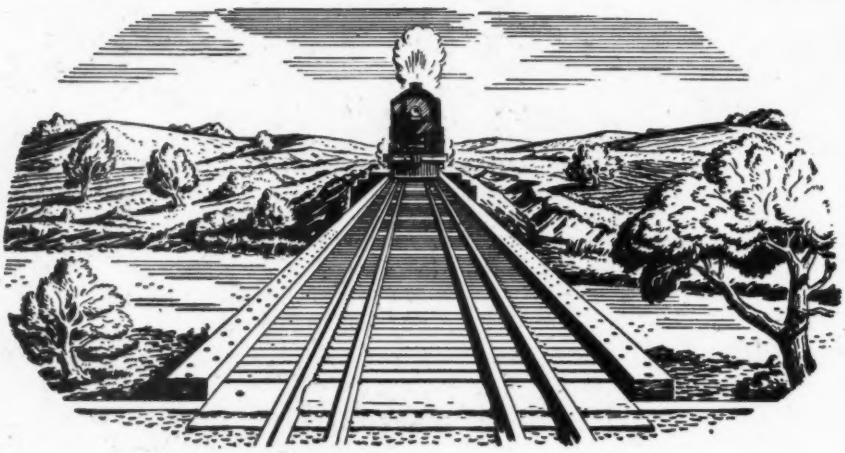
NORTHWEST

SHOVELS • • CRANES • • DRAGLINES • • PULLSHOVELS

Proved on the Nation's Leading Railways

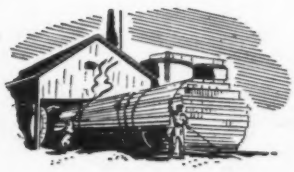
FORWARD THINKING RAILROAD MEN . .

build bridges resistant to fire and decay



Bridges and trestles built of Wolmanized* lumber last longer, with no added fire hazard. The Wolman Salts* preservative, driven deep into the wood, resists decay . . . will not corrode bolts, drift pins, spikes or timber connectors. Shop and freight-house timbers treated with Minalith* fire-retardant are flameproof. These treatments guard against the constant threat of premature destruction.

Pressure Treatment assures thorough protection



Pressure treatment under exacting laboratory control drives these protectives deep into the wood. Hundreds of millions of feet of lumber so treated are in service all over the world.

AMERICAN LUMBER & TREATING COMPANY

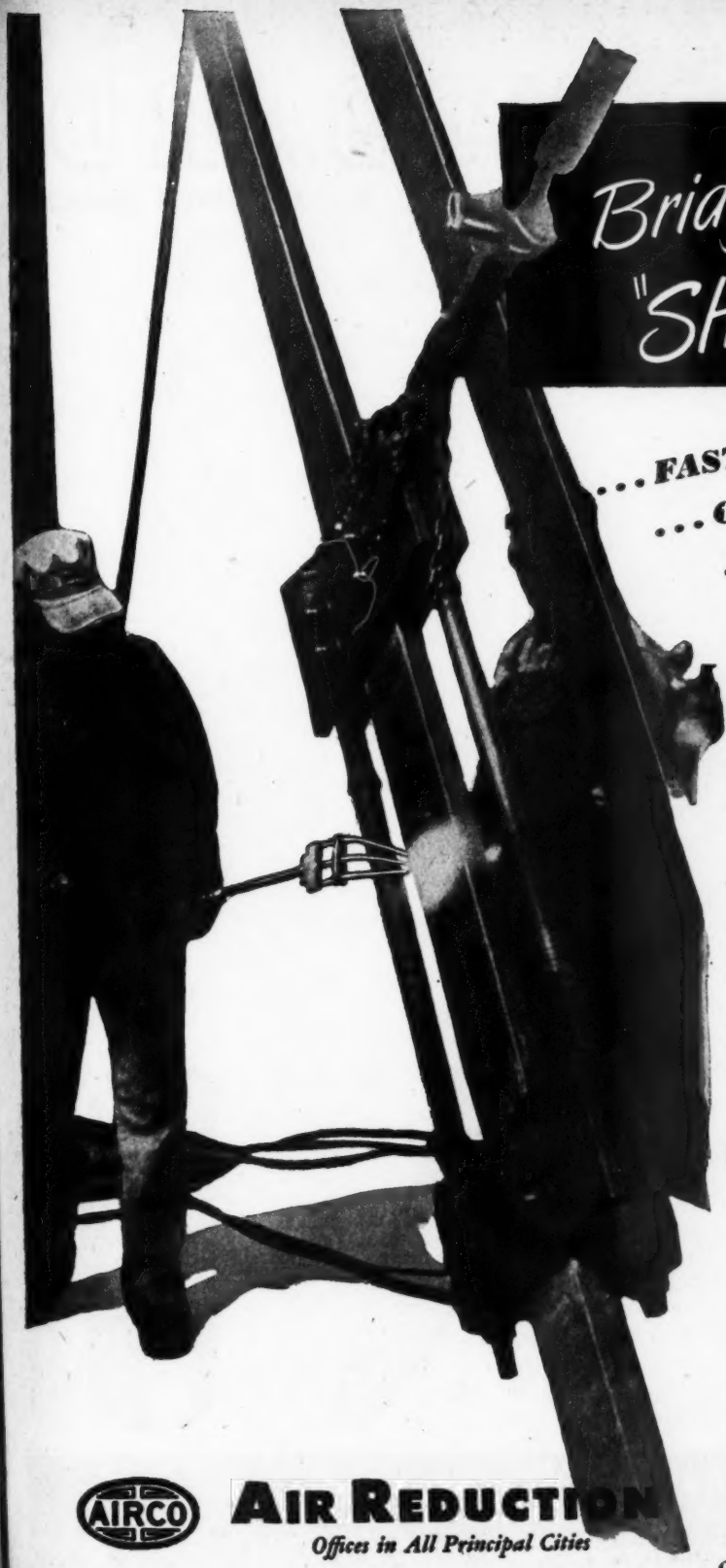
CREOSOTING

FLAMEPROOFING

WOLMANIZING

*Registered trademarks

1659 McCORMICK BUILDING, CHICAGO 4, ILLINOIS



Bridge Braces "SHRINK" fitted

. . . FASTER
. . . CHEAPER
. . . WITHOUT LOSS OF TRAFFIC TIME

Today, many railroads have turned the old process of "flame shortening" into a new time-saving and cost-saving technique for reducing the slack in bridge eye-bar tension members.

Using standard Airco oxyacetylene flame heating equipment, "flame shortening" consists of locally heating the bridge member to be shortened, while applying axial, upsetting pressure to the member by means of a yoke. The yoke is clamped to the member on each side of the spot being heated.

Fast . . . economical . . . without any apparent effect upon the fatigue strength or the static strength of the steel, this modern adaptation of an old process can shorten eye-bars as heavy as 10" x 2" . . . and, can be carried on between regular scheduled train runs — an important factor to consider when determining work feasibility.

For further information about this unique process, write your nearby Airco office, or: Air Reduction, General Offices, 60 East 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas.

AIRCO **AIR REDUCTION**
Offices in All Principal Cities

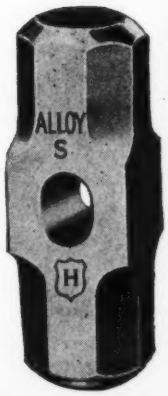
Costs Come Down Under the Airco Plan

HUBBARD

SUPER STEEL ALLOY TRACK TOOLS

Finest Quality
Dependable Service
Longest Life

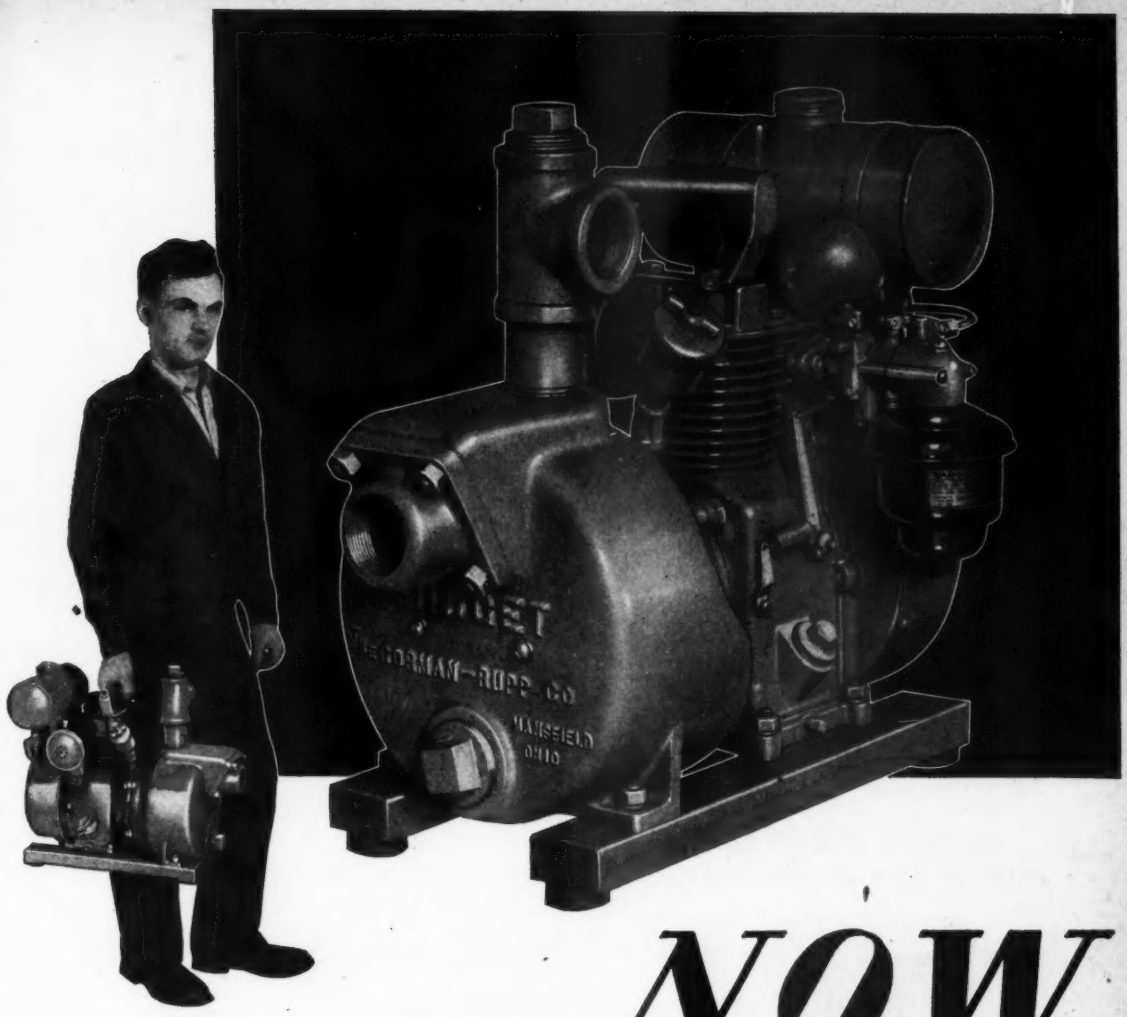
MEET ALL
A.R.E.A.
SPECIFICATIONS



New York Office
3712 Woolworth Bldg.
233 Broadway
New York (7), N.Y.

HUBBARD and COMPANY
Tool Division
Manufacturers of Alloy Spring Washers & Rail Anchors
6301 Butler Street
Pittsburgh (1), Pennsylvania

Chicago Office
Room 924
332 S. Michigan Ave.
Chicago (4), Ill.



. . . NOW

You can have a pump with your tool kit!

The Gorman-Rupp "Midget" is a lot of pump in a very small package. Although it weighs only 60 pounds, it will pump 3000 gallons per hour against a 20 ft. head and will do it for months at a time without attention. The Midget is the smallest of four Gorman-Rupp lightweight pumps. These handy pumps can handle many small drainage jobs and can be quickly and easily transported. They are the toughest little pumps you ever saw and are simple to operate—no valves—fully automatic, self-priming. They are non-clogging—any muck or solids that will pass the intake strainer will clear through the pump.

Other Gorman-Rupp centrifugal pumps are made in sizes ranging up to 125,000 gallons per hour capacity.

Try a Gorman-Rupp on your next job. If it does not do a better job than any pump you ever saw, you can return it at our expense. Write for further information or contact your distributors.

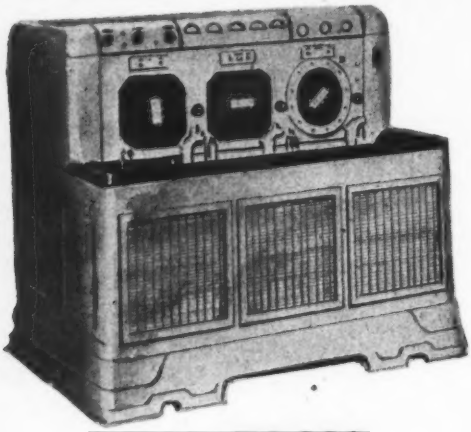
THE GORMAN-RUPP COMPANY

GORMAN-RUPP PUMPS — UNSURPASSED FOR PUMPING FAST

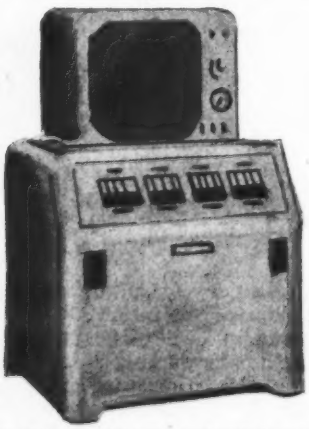
332 N. BOWMAN STREET • MANSFIELD, OHIO

FOR A BETTER JOB

MODERN INDUCTION HARDENERS



MADE BY TOCCO
PRICED FOR QUICK SALE



Although this material has previously been offered to priority claimants, 10 per cent of the merchandise has been reserved to fulfill any further needs of priority claimants including VETERANS OF WORLD WAR II who are invited to contact the Regional Office serving their area.

A large number of TOCCO induction heating furnaces, used and unused, are now available for immediate sale. These are late developments in controlled surface hardening by high frequency induction. The furnaces are designed to give selective and uniform hardening—cut costs—boost output—save space—fit easily into your production line.

It will definitely pay you to consider the use of this equipment for your surface hardening requirements. All items subject to prior sale.

SPECIFICATIONS:

9600 cycles; 1, 2, or 3 station 220/440 volt, 3-phase, 60 cycle, range 7½ to 125 KW; and 200 KW machines at 3000 cycles.

Use this coupon to obtain complete information on the machine you want. Simply mail it to your nearest W.A.A. Regional Office.

TO WAR ASSETS ADMINISTRATION:

Please send me, without obligation, full information on the price, location and condition of Induction Heating Equipment of the following types:

.....

.....

Name .....

Firm .....

Address .....

City ..... State .....

EXPORTERS

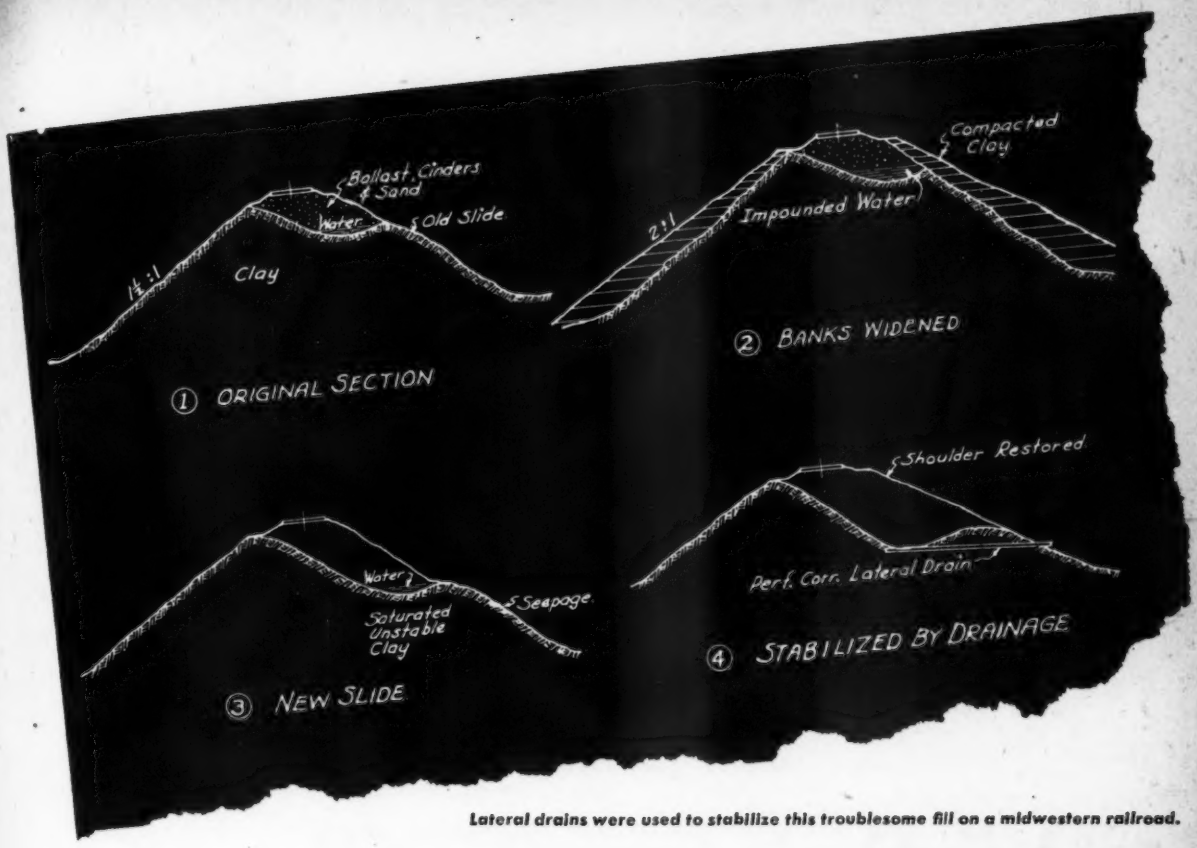
The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

Offices located at: Atlanta • Birmingham Boston • Charlotte • Chicago • Cincinnati Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville Kansas City, Mo. • Little Rock • Los Angeles Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha Philadelphia • Portland, Ore. • Richmond St. Louis • Salt Lake City • San Antonio San Francisco • Seattle • Spokane • Tulsa

700-3



Lateral drains were used to stabilize this troublesome fill on a midwestern railroad.

How this long fill was stabilized by tapping 9′ ballast pockets

• When maintenance engineers tackled this mile-long trouble spot of mucky black gumbo soil, they found ballast pockets to a depth of 9 feet under the ends of each tie.

Timber piles failed to stop earth-slides; so maintenance men looked to ARMCO Perforated Pipe. Here they found the answer.

Lateral drains installed about a foot below the ballast pockets completely drained the impounded water. Speed restrictions were lifted, and this section of roadbed no longer required extra maintenance.

ARMCO Perforated Pipe can give you quick, efficient drainage wherever ballast pockets prove costly. The flexible corrugated metal design and strong joints resist crushing and disjointing under heavy loads at high speeds.

An Armco engineer will gladly give you full information about ARMCO Perforated Pipe. Write your nearest Armco Drainage & Metal Products, Inc. office—or the general offices of the company, 2165 Curtis Street, Middletown, Ohio.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

Fill drains of ARMCO Perforated Pipe continue to operate even during the winter.

ARMCO

Armco Drainage & Metal Products, INC.

new!

CP-5 Gasoline Tie Tamper

is outstanding for ease and efficiency of operation and low maintenance

EASY STARTING by merely pressing on handle.

NO BATTERIES. Magneto-ignition, dependable under all conditions, eliminates costly battery replacements.

TWO-CYCLE ENGINE operates on gasoline-oil fuel mixture.

AUTOMATIC LUBRICATION by oil in fuel. Residual crankcase oil lubricates gear case, striking mechanism and bar snubber.

BALANCED WEIGHT as weight of tamper is centered between grip handles.

VISIBILITY OF WORK. Slender contour of lower end of tool gives unobstructed view of bar.

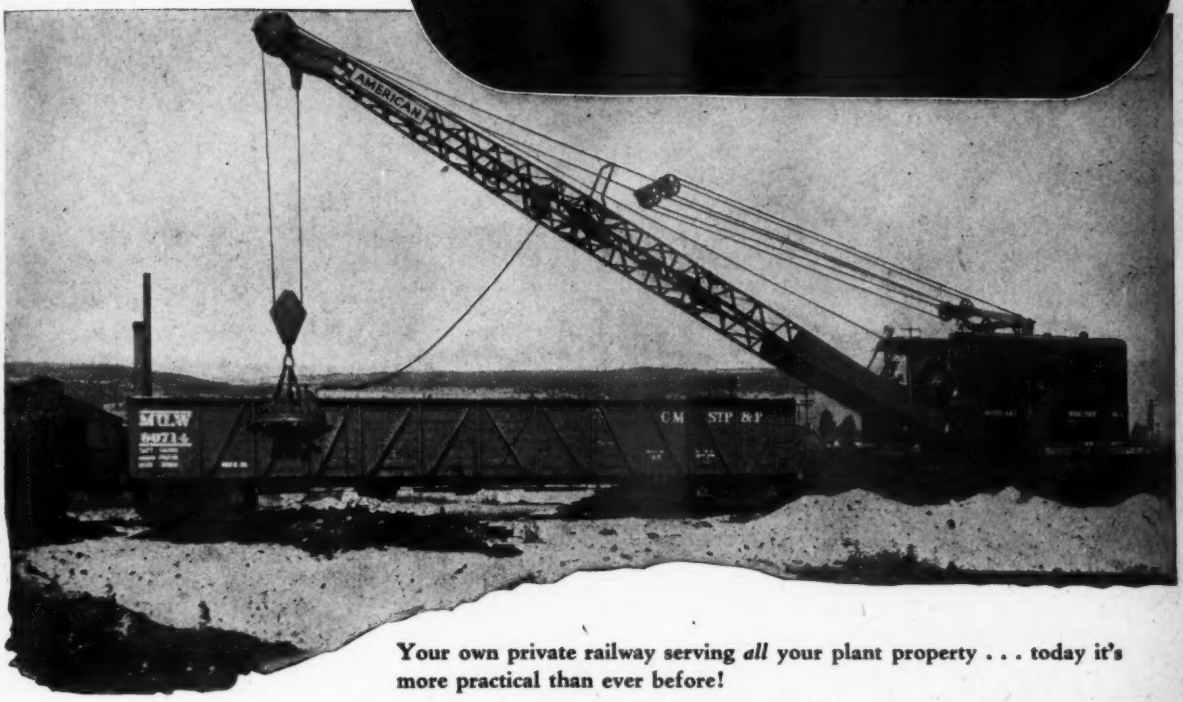
Write for further information.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

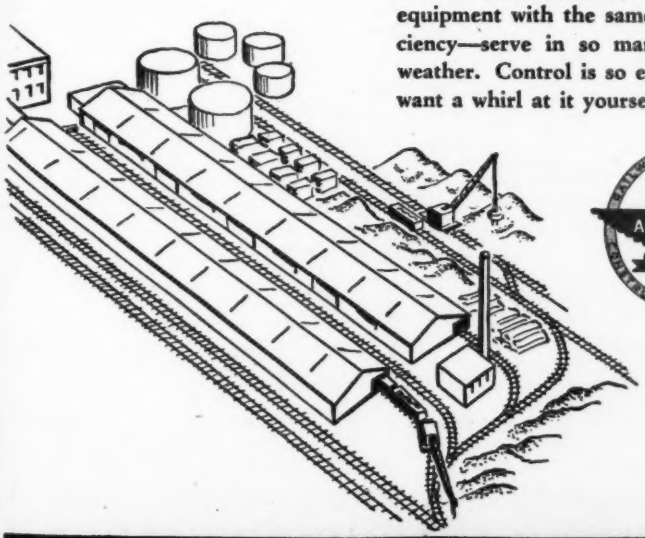
Private Railways, Unltd.



Your own private railway serving *all* your plant property . . . today it's more practical than ever before!

Rail-served storage and stockpiling facilities are now the lowest cost available for many industrial and power plants, small as well as large. Reason: the new "American" Diesel-Electric Locomotive Crane.

You don't need a large volume of work to make a small capacity Diesel-Electric profitable, and a large capacity will handle huge tonnages. It will out-switch ordinary switch engines. And no other loading-unloading equipment with the same capacity will approach its flexibility and efficiency—serve in so many ways over such large areas regardless of weather. Control is so easy workmen enjoy using this new tool—you'll want a whirl at it yourself. Write for Catalog 600.



AMERICAN

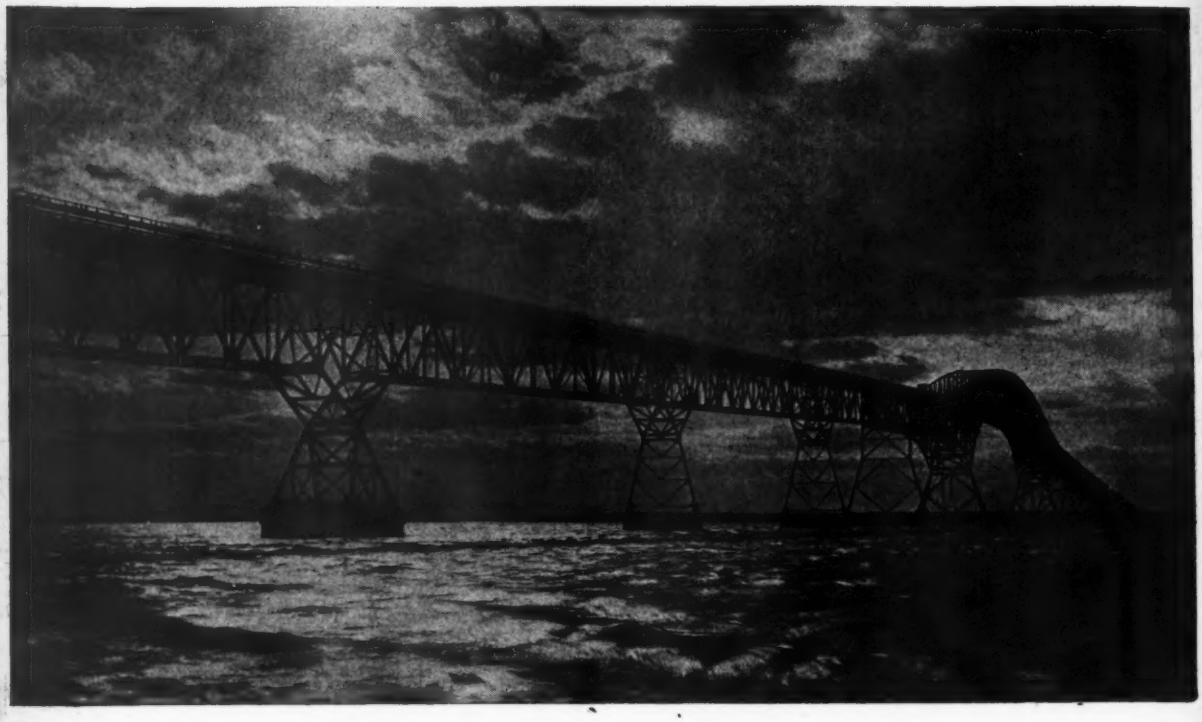
American

HOIST & DERRICK CO.

St. Paul 1, Minnesota

CHICAGO SAN FRANCISCO NEW YORK

WE BUILD BRIDGES



The building of the sub structure of this great highway bridge between Ludlow Ferry, Md., and Dahlgren, Va., by the Merritt-Chapman Scott Corporation involved the solution of construction problems of the first order including the driving of inclined steel "H" piles up to 215 feet in length

We fulfilled major contracts on these projects:

Potomac River Bridge	Dahlgren, Va.
Susquehanna River Bridge	Muncy, Pa.
Washington Bridge	Providence, R. I.
Waldo Hancock Bridge	Bucksport, Me.
Saginaw River Bridge	Saginaw, Mich.
Mount Vernon Memorial Bridges	Virginia
Lake Champlain Bridge	Port Henry, N. Y.
Narragansett Bay Bridge	Jamestown, R. I.
Cape Fear River Bridge	Wilmington, N. C.
Northeast River Bridge	Wilmington, N. C.
Eight Bridges, Union Pacific RR	Long Beach, Calif.
Poquetannuck Cove Bridge	Thames River, Conn.

Mississippi River Bridge Memphis, Tenn. (now under construction)

MERRITT-CHAPMAN & SCOTT CORPORATION

FOUNDED
1860

17 BATTERY PLACE NEW YORK 4, N. Y.

for THE TRACK MAINTENANCE MAN —

The Guy that's Really on the SPOT!

JACKSON

Tampers . . . power plants and methods are an incomparable combination for producing better, longer-lasting roadbeds.

It's a far cry from the pot-bellied, funnel-stacked "dummy" to the giant million-pound locomotive, mile-long freight trains and whizzing streamliners. And the guy that's responsible for track maintenance, today, is really on the spot. It takes a lot of heroic doing, the best of equipment and organization to provide track capable of taking the terrific pounding of present traffic demands. If you're that fellow and haven't as yet read your copy of our recently published booklet, "Let's Organize that Gang," by all means do so now. If you have mislaid it, write for another copy. Next to actually talking with a JACKSON field engineer, it's the best way to get the accumulated experience of the leading railroads in all parts of the country. Your gang foremen and extra-gang foremen will also benefit greatly from reading it. Shoot us their names and addresses and we'll send them copies pronto!

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

Day and Night

PERMUTIT* CONDITIONED WATER KEEPS THESE DIESEL GIANTS IN TOP OPERATING SHAPE!

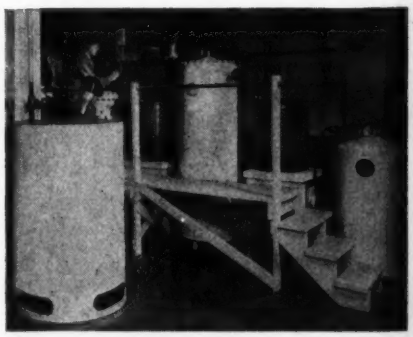
Around-the-clock Permutit protection!

Like all Diesels, the giant engines of the Great Northern Railway require demineralized water for their cooling systems. A Permutit Demineralizer in Great Northern's modern service and repair shop at Havre, Montana provides this mineral-free water 24 hours a day—a constant supply of pure water, free from the minerals and impurities which cause scale.

Operating experts keep efficiency high and operating difficulties down by installing Permutit Demineralizers at divisional points. This equipment reduces total solids due to calcium, magnesium and sodium to as low as 5 ppm. Treatment cost is frequently as low as 5% of the cost of distillation.

Write for information about Permutit Demineralizers to The Permutit Company, Dept RE11, 330 West 42nd St., New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

*Trademark Reg. U.S. Pat. Off.



PERMUTIT DEMINERALIZER—in service at the Great Northern Railway's diesel service shop at Havre, Montana. Treated water is stored in a 2,000 gallon tank and is pumped into the cooling systems of the locomotive.

PERMUTIT

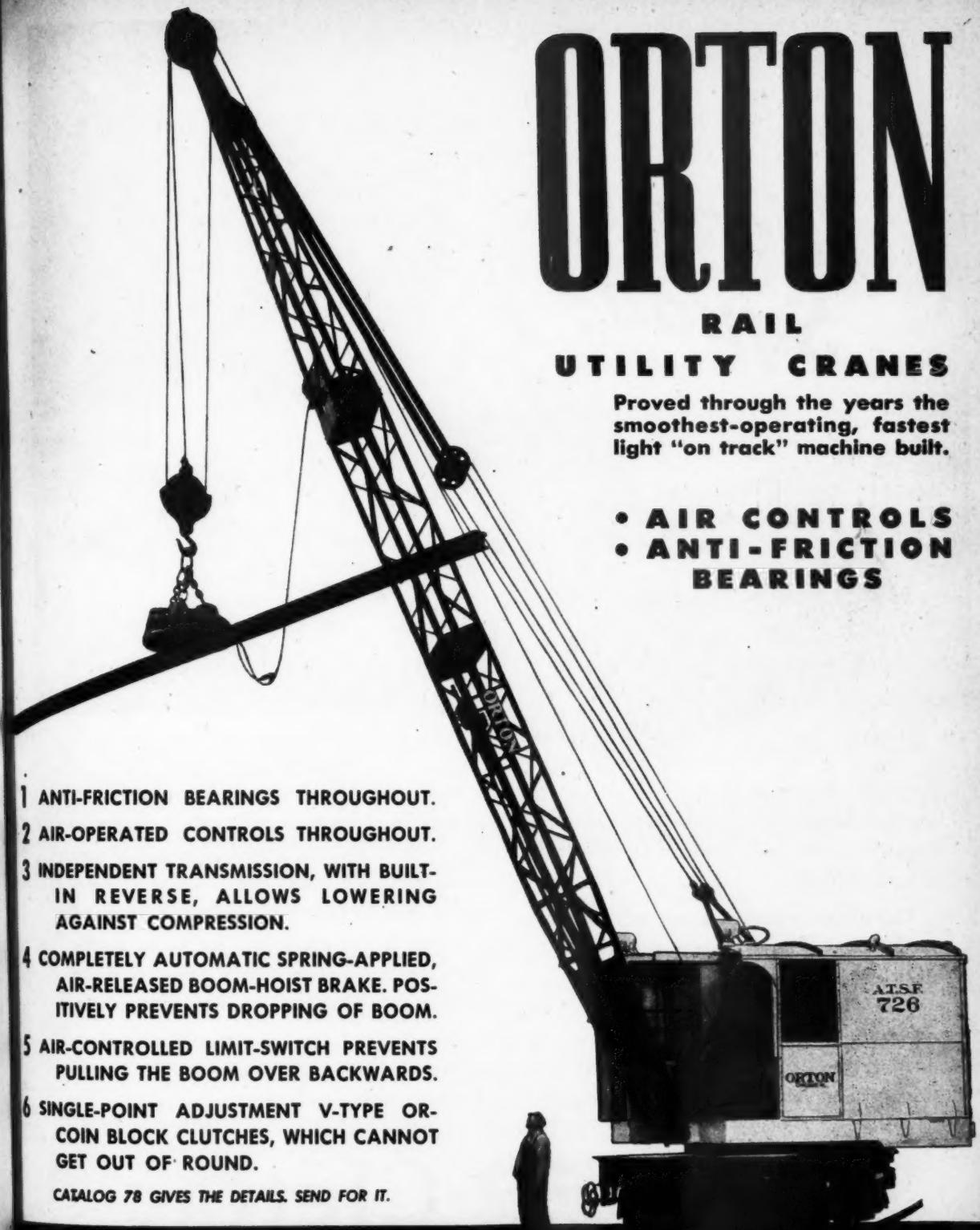
WATER CONDITIONING HEADQUARTERS

ORTON

RAIL
UTILITY CRANES

Proved through the years the smoothest-operating, fastest light "on track" machine built.

- **AIR CONTROLS**
- **ANTI-FRICTION BEARINGS**



1 ANTI-FRICTION BEARINGS THROUGHOUT.

2 AIR-OPERATED CONTROLS THROUGHOUT.

3 INDEPENDENT TRANSMISSION, WITH BUILT-IN REVERSE, ALLOWS LOWERING AGAINST COMPRESSION.

4 COMPLETELY AUTOMATIC SPRING-APPLIED, AIR-RELEASED BOOM-HOIST BRAKE. POSITIVELY PREVENTS DROPPING OF BOOM.

5 AIR-CONTROLLED LIMIT-SWITCH PREVENTS PULLING THE BOOM OVER BACKWARDS.

6 SINGLE-POINT ADJUSTMENT V-TYPE ORCOIN BLOCK CLUTCHES, WHICH CANNOT GET OUT OF ROUND.

CATALOG 78 GIVES THE DETAILS. SEND FOR IT.

ORTON CRANE & SHOVEL COMPANY
608 S. DEARBORN ST., CHICAGO 5, ILL.

SENSITIZED

POWER

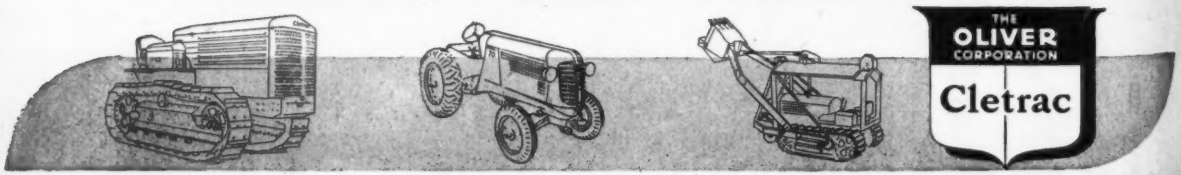
For fast, economical clean-out of ditches, the one-man clean-up squad . . . an Oliver "Cletrac" crawler tractor equipped with a Drott bullclam is hard to beat!

This efficient combination not only scrapes up the fill but also carries the surplus dirt out of the ditch and deposits it in low spots or wherever desired. The unit can serve as a scraper, shovel, grader or bulldozer . . . important advantages for ditch cutting or cleaning, grading and fill-in work. It's a real one-man maintenance crew!

The patented steering of Oliver "Cletrac" tractors is particularly important for right-of-way work. The easy, positive control and greater maneuverability assure greater safety . . . permit the tractor to work close around poles and culverts. It also allows the tractor to handle heavy front-end loads without excessive strain and wear on frames and steering mechanisms.

For all the facts, write **The OLIVER Corporation,** *Industrial Division*, 19300 Euclid Avenue, Cleveland 17, Ohio.

OLIVER-Cletrac



● **POWER TRACK DRILLS**

The Buda Power Track Drill, a tested, carefully engineered track tool embodies all the advantages that a track man requires. Light, fast and safe . . . a modern unit that provides faster, easier drilling of bolt holes in any weight rail. Adjustments are provided so that drill bit can be raised or lowered for accurate drilling. Overclutch hook may be instantly released without stopping or backing bit off rail. Drill is easily removed from track in less than ten seconds.

Write today for descriptive literature on Buda maintenance-of-way equipment

● **RAIL BENDERS**
Heavy stock and guard rail bends are easily made in the field by one man using a BUDA Rail Bender.

BUDA

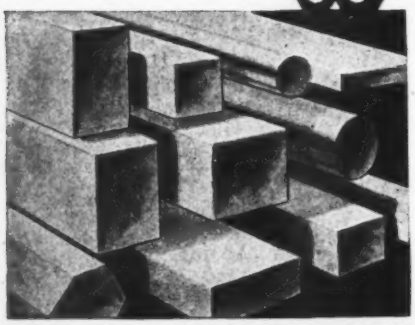
15403 Commercial Avenue
HARVEY *(Chicago Suburb)* **ILLINOIS**

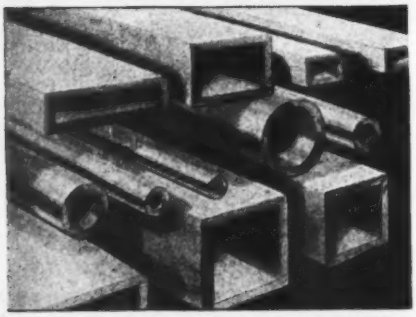
BUDA
Track Liners

BUDA
Track Jacks

NOW

Brass Mill Products Quickly!





A large supply of brass mill products is now offered to the trade at unusually low prices. The entire inventory may be fabricated by normal production methods and is being sold in production quantities.

The inventory includes: Free Turning Brass Rod—1 inch diameter and larger; Copper and Brass Tubing—3 inch O.D. and larger; Naval Brass Rod—various diameters; Aluminum Bronze, Manganese Bronze and Silicon Bronze in various shapes.

• • •

This material is offered in the following sequence as provided by law: (1) Certified Veterans of World War II; (2) Subsequent priority claimants; (3) Non-priority purchasers. Federal agencies have had opportunity to fulfill their needs. VETERANS OF WORLD WAR II should apply to their nearest WAA Regional Office for certification; the case number assigned and the location of the certifying office must be stated in a Veteran's offer to purchase.

EXPORTERS: The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

Offices located at Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

157-4A

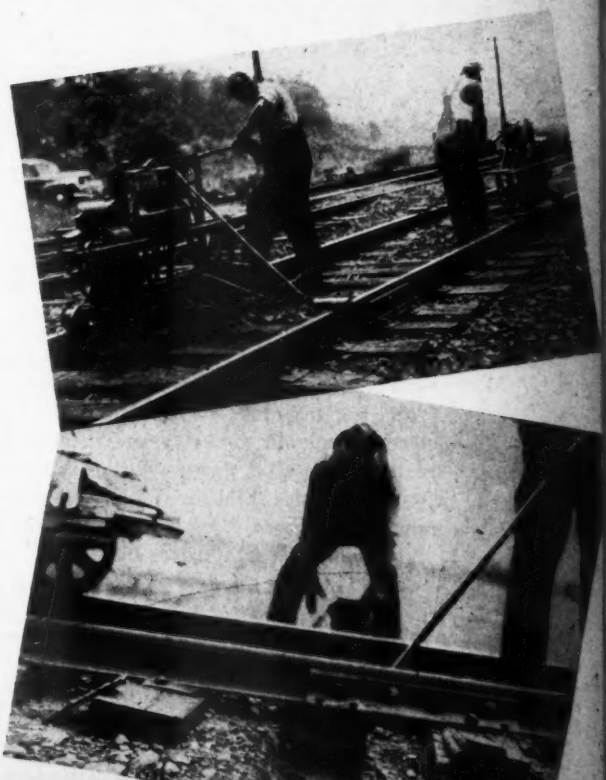
CONSISTENT SAFETY RECORDS MEAN

conscientious track maintenance

Seventy miles of track in this open-pit mine.

DULUTH MISSABE & IRON RANGE

Safety first makes the DM&IR first for safety. This year, for the 11th time, it merited the American Museum of Safety's coveted annual award, the E. M. Harriman Silver Medal, for Class B railroads.



Underlying every successful program to further safety in railroad operations, there must be an effective plan of roadbed maintenance to keep the right-of-way in prime condition. Even an inch of faulty track can be a serious safety hazard, liable to cause far-reaching trouble. A leader in promoting safety, the Duluth, Missabe & Iron Range R.R., the nation's largest iron ore-hauling carrier, demonstrates in the upkeep of its 1159 miles of heavy-duty track the most progressive methods of maintenance by the use of modern machinery, including WOOLERY TIE CUTTERS.

Your inquiry will bring detailed information on cost and performance data.

Hundreds of Woolery Tie Cutters are in use on the railroads of America today, helping them save 30% or more on tie-replacement costs.

The reciprocating blades of these efficient machines make two cuts in each tie, just inside the rails, leaving it in three easily-removed pieces, with the tie bed undisturbed, and causing no disruption in traffic.

Fifty cuts an hour, including moving and all delays, is their average speed, and blades make 50 to 100 cuts without resharpening. A convenient attachment, an integral part of the machine, resharpens a blade in 3 or 4 minutes. Every WOOLERY TIE CUTTER is *fully guaranteed.*

More than 75 Railroads use

WOOLERY MAINTENANCE EQUIPMENT

Tie Cutters Weed Burners Creosote Sprayers

Available in 5-burner, 3-burner, 2-burner, and 1-burner models.

WOOLERY MACHINE COMPANY

MINNEAPOLIS Pioneer Manufacturers of MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS · MOTOR CARS · TIE CUTTERS · TIE SCORING MACHINES · RAIL JOINT OILERS · CREOSOTE SPRAYERS · BOLT TIGHTENERS

EXCLUSIVE EXPORT REPRESENTATIVES PRESSED STEEL CAR COMPANY INC PITTSBURGH PENNA

ALL THESE JOBS *with* THIS ONE TOOL!

Breaking Concrete, Rock, Ice, etc.

Asphalt Cutting

Sheeting Driving

Clay Digging

Spike Driving

Dirt Tamping

Thor

PAVING BREAKERS

More than just a Buster is a Thor Paving Breaker! With moil points, chisels, wedges, and broaches in 7 styles it breaks concrete, rock, ice, and other materials. With wide-bladed spades it digs clay and hard-pan; cuts asphalt; splits timbers. With a tamper tool it pounds backfill. With an interchangeable Front Head it drives spikes. With another Head it drives sheeting.

And, whatever the job, Thor Breakers are bonus makers. An exclusive short-travel tubular valve, that gets more work from all the air, controls the extra power to drive a reversible, block-type piston in smooth blows. Rugged construction, full air-cushioning and automatic lubrication reduce wear. Get these benefits on your jobs now —ask your nearby Thor Distributor.

INDEPENDENT PNEUMATIC TOOL COMPANY

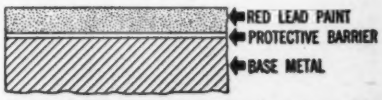
600 W. Jackson Blvd., Chicago 6, Illinois

Birmingham Boston Buffalo Cleveland Detroit Los Angeles Milwaukee New York Philadelphia
Pittsburgh St. Louis Salt Lake City San Francisco Toronto, Canada London, England

Thor PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

Red Lead halts Rust-Producing ELECTRO-CHEMICAL ACTION



The invisible safeguard against corrosion
This diagram shows the interfacial film, located at the metal and paint-film interface. The formation and the maintenance of this shield by Red Lead halts electro-chemical action . . . safeguards the metal against rust.

No other protective paint for metal has ever known such wide acceptance by industry, through the years, as Red Lead. And recent scientific research has disclosed that Red Lead's outstanding performance results from basic characteristics of the pigment itself.

Not the least important of these is the ability of Red Lead to halt electro-chemical action — the fundamental cause of rusting.

In this action weak currents are generated, due to physical and chemical differences in the metal and to other factors. These lead to corrosion of the iron.

These factors are always present, but their effects are eliminated by Red Lead.

Here's what happens: Red Lead, because of its singular composition, possesses properties which enable it to form a compact, tightly adherent, protective film, located at the interface of the metal and the paint coating. See cross section diagram above.

This film — so thin that it is not apparent to the human eye — is in very intimate contact with the metal, and its formation halts electro-chemical action — and the corrosion of the metal.

Once formed, it is essential that the continuity of the film be maintained — if the shield is to be effective. When Red Lead pigmented paint is used, any small breaks in the protective shield, due to abrasive action or otherwise, are readily healed. The metal remains in a rust-inhibited condition as long as Red Lead coats the surface.

Specify RED LEAD for All Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

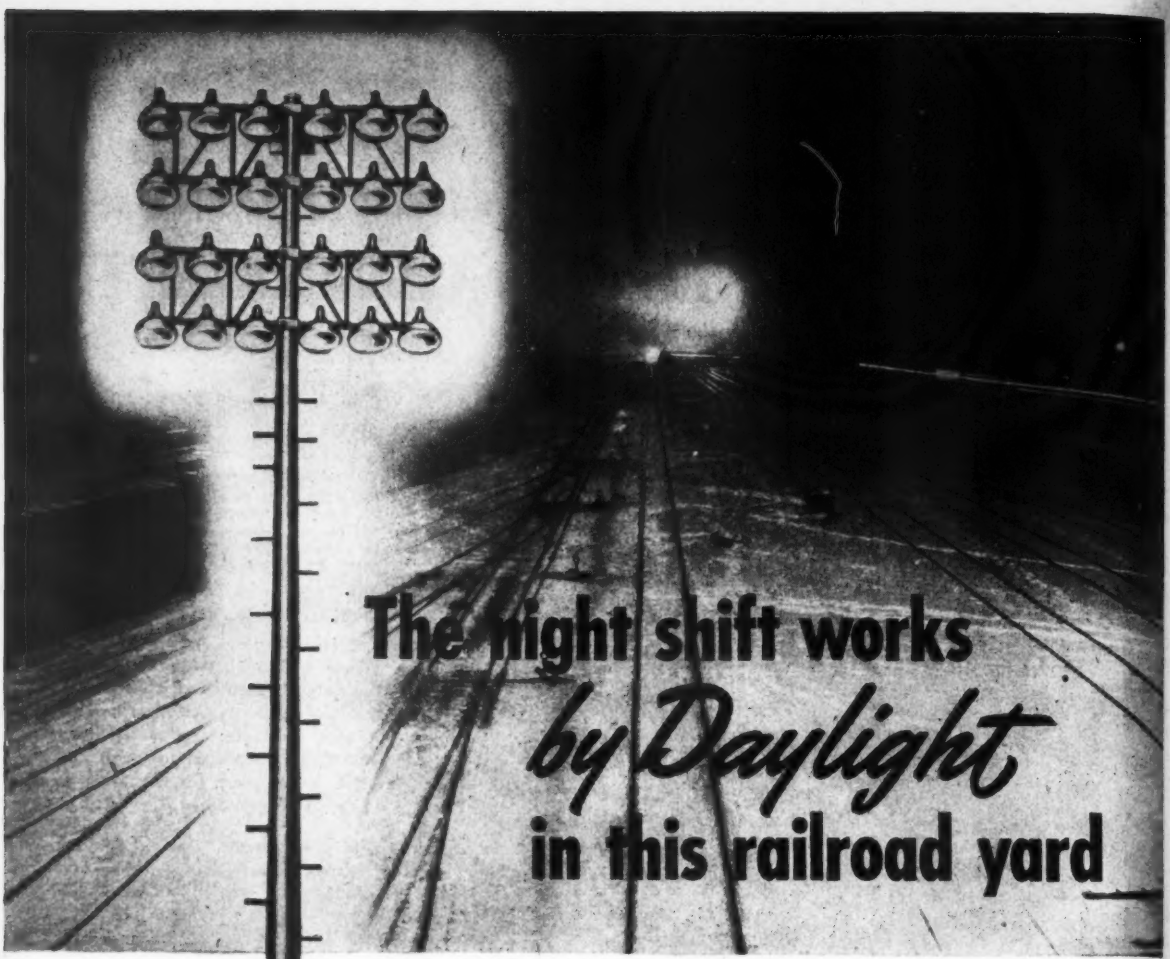
Write for New Booklet "*Red Lead in Corrosion Resisting Paints*" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6; Buffalo 8; Chicago 80; Cincinnati 3; Cleveland 13; St. Louis 1; San Francisco 10; Boston 6, (National Lead Co. of Mass.); Philadelphia 7, (John T. Lewis & Bros. Co.); Pittsburgh 30, (National Lead Co. of Pa.); Charleston 25, W. Va. (Evans Lead Division).

Dutch Boy Reg. U. S. Pat. Off.
Red Lead



The night shift works *by Daylight* in this railroad yard

THE intricate networks of rails, switches and feeders in railroad yards are made easily visible at night with light distributed by Union Metal's Steel Floodlighting Poles.

Consider the benefits! Greater safety for workers—insurance against property damage and loss of life—increased efficiency.

Engineered to provide maximum strength and durability, Union Metal's new Floodlighting Poles offer you these:

FEATURES

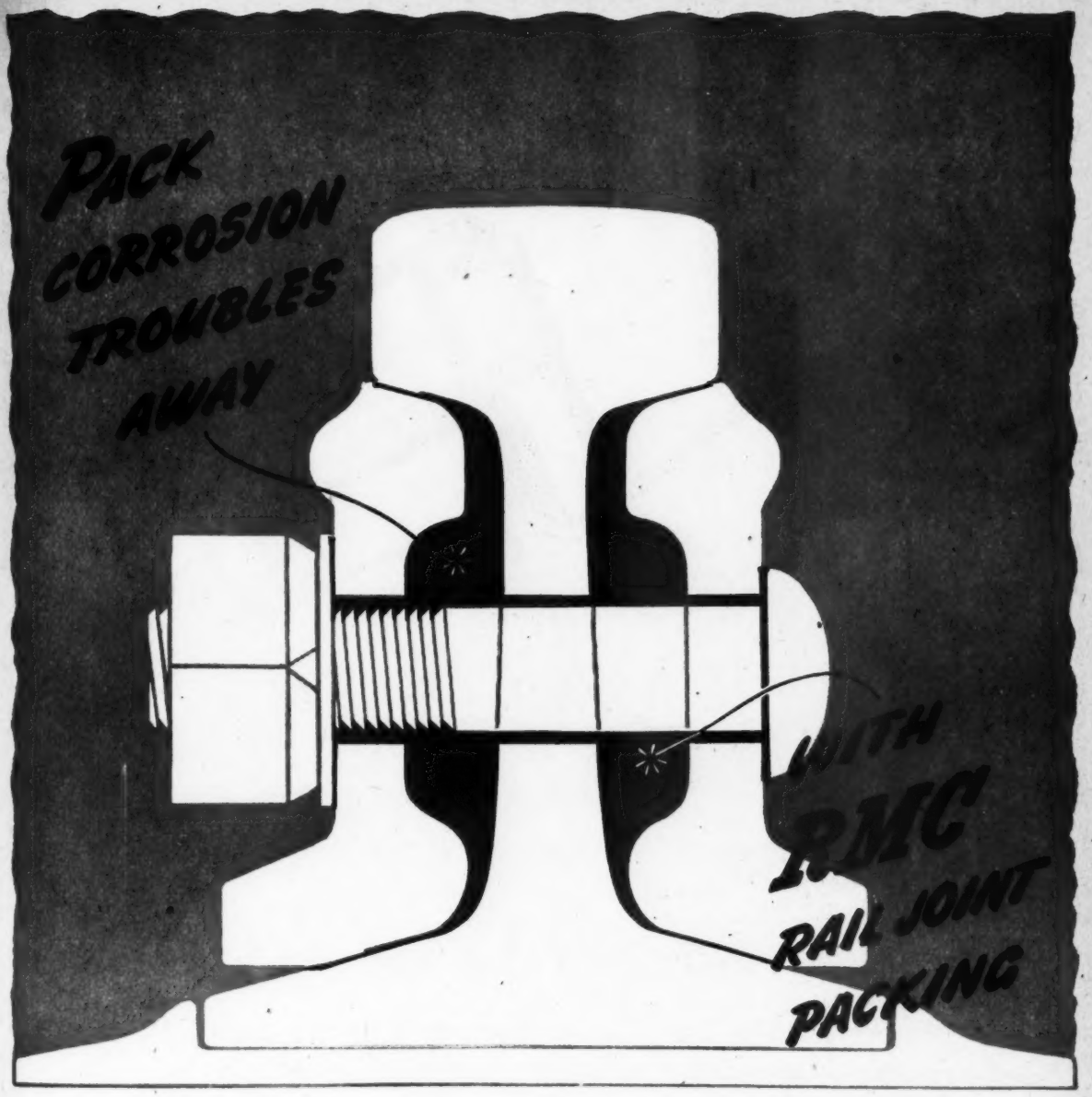
1. Tapered and cold rolled.
2. Complete with combination safety platform and mounting frames.
3. Can be completely wired and lights mounted before erection.
4. No guying necessary.
5. Good appearance, great strength.
6. Standard heights: 40, 60, 80, 100 feet.

For catalog giving engineering details, write to The Union Metal Manufacturing Company, Canton 5, Ohio.

1908-1948
40 YEARS OF PROGRESS IN THE DESIGN AND FABRICATION OF STEEL PRODUCTS

UNION METAL

Monotube Floodlighting Poles



One application of RMC Rail Joint Packing stops rail joint corrosion for the life of the joint. It is the modern method of permanently protecting rail joints and has been used successfully on millions of them by leading roads. In addition to preventing corrosion, RMC Packing assures that properly tensioned bolts will not "freeze" the joint and cause kinked or humped track. Write today for complete information.

RAILWAY MAINTENANCE CORP.

PITTSBURGH 30, PENNSYLVANIA

WHERE THE GOING IS TOUGHEST

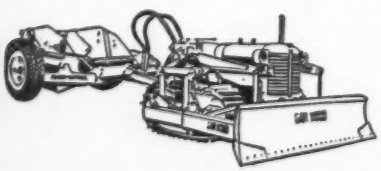
...SPECIFY GAR WOOD!

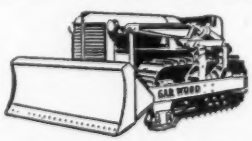
In use everywhere for clearing, leveling, grading, and excavating ...All Gar Wood Road Machinery is specifically designed, engineered, and built to make the *toughest* jobs *easy*...and more profitable.

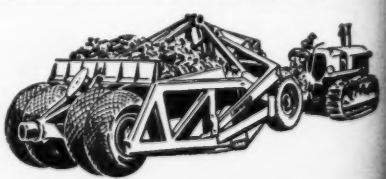
That's a *fact*... for Gar Wood Bulldozers and Dozecasters are the result of practical, down-to-earth engineering. They're constantly being proven and reproven in the field...in mining, quarrying, lumbering, railroading, and general contracting.

Moving the four corners of the earth, rebuilding a war-torn world, Gar Wood Road Machinery has *got* to be good. For your next job... *particularly if it's a tough one*... specify Gar Wood.

GAR WOOD GW TRADE MARK INDUSTRIES







SEALTITE CAR BOLT

1 THIN HEAD

The thin, reinforced, braced head is designed to be flush when drawn up. It displaces a minimum amount of wood and affords a perfectly smooth, level-with-the-surface seal without countersinking.

2 BEVELED EDGE

The scientifically designed beveled edge dapes and compresses without breaking the wood fibres and without raising surface splinters.

3 TAPERED HEAD

The thin tapered and beveled head has no sharp edges to cut or tear the surface of the wood. It pulls flush with the surface, protecting the installation against moisture damage, rust or wood rot. Sealtite Bolts form a perfect watertight seal.

4 ROUND SHANK

By having the round shank extend to the base of the thin tapered head we reach the technical and practical goal of putting the bolt into a round hole of exactly the same diameter as the bolt shank—providing a complete contact fit free from air pockets and consequent corrosion.

5 PATENTED FINS

The Sealtite fins are patented. Scientifically designed to brace the head of the bolt so that it is extra strong yet is decidedly thin and tapered. The Sealtite fins present 4 surfaces lying exactly on radial planes of the bolt to provide maximum resistance against turning when the bolt is pulled flush with the surface. Countersinking is unnecessary. The four fins wear into flutes of the wood, compressing it and wedging action, resulting in locking of the wood.

6 ACCURATE THREADING

Sealtite bolts are accurately threaded to [illegible] Perfect threads are a prime requisite for ease of installation.

SEALED-TITE IN ZINC BOLTS Although many [illegible] Sealtite bolts [illegible] Sealtite bolts [illegible] Sealed-in-Zinc, put [illegible] Sealtite. This [illegible] means lasting, [illegible] and many years of life by stopping rust and corrosion.

LEWIS BOLT & NUT COMPANY
504 Malcolm Avenue S.E., Minneapolis, Minnesota

DESIGNED TO DO A BETTER JOB

JUST A Handful...

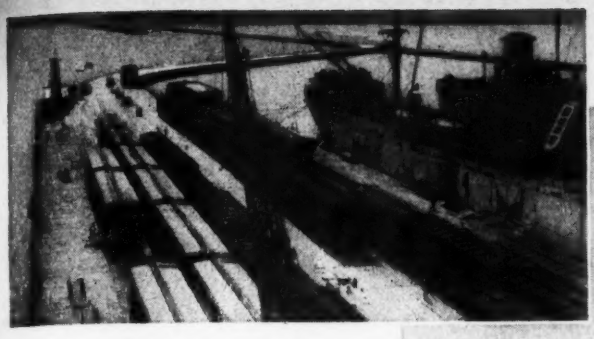
But with a light-weight gasoline-engine-driven Homelite Generator you have plenty of current to operate brilliant floodlights and cost cutting electric tools.

Let us give you a free on-your-job demonstration. Simply write us today.

HOMELITE

Portable PUMPS • GENERATORS • BLOWERS

HOMELITE CORPORATION
PORT CHESTER, NEW YORK



These PRESSURE-CREOSOTED piles

lick a peace-time submarine menace

Extending for three miles, this tremendous pier on the Atlantic Coast carries miles of railroad track, and has facilities for loading a hundred ships at once. Since it was designed for permanent use, the engineers specified permanent materials, including pressure-creosoted piles and other structural members. Much of this material was treated by Koppers plants.

The importance of the protection of pressure-creosoting is shown by the almost incalculable damage done by marine borers to untreated piles. In a single west-coast harbor installation, damage has been estimated at $6,000,000 annually.

Experienced engineers depend on pressure-creosoted piles, as is indicated by their ever increasing use. In a recent 5-year period, 144,000,000 lineal feet were installed—enough to more than girdle the globe at the equator.

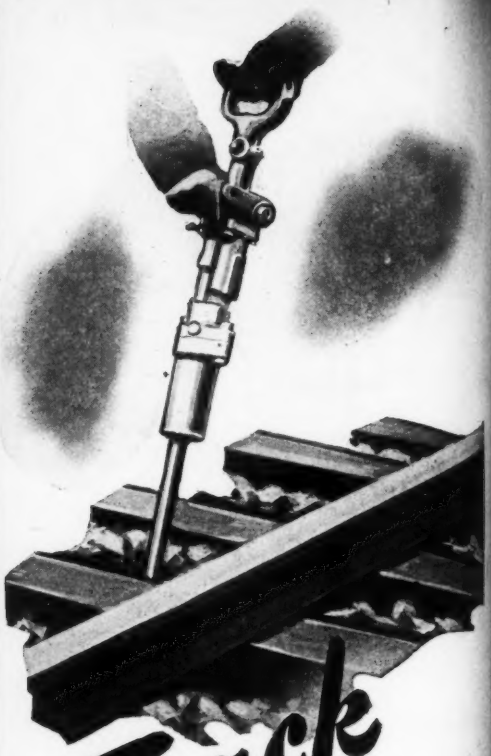
Pressure-creosoted foundation piles offer equally dependable protection against decay in installations where cut-offs are above the water table, and they also resist termite attack. Koppers plants are equipped to treat piles up to 130 feet long. Ask for quotations.

K

KOPPERS

PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC., Pittsburgh 19, Pa.



the Track IS THE BACKBONE

It's just that simple. Without the track you couldn't have a railroad.

The better the track the better the railroad—and there's a reason for it. Good track is imperative for big and prompt schedules. And, *air-operated* tie tampers provide one of the easiest and surest aids towards producing a uniform track job.

Our MT-3 tie tamper is a favorite of section gangs because it is so easy to handle. They simply guide the machine and let it do the fatiguing work for them.

Don't slight your railroad backbone—put I-R *air-tampers* and *compressors* to work right now. For recommendations, call our nearest representative.

SEVENTY-FIFTH ANNIVERSARY

AIR TOOLS
COMPRESSORS
CONDENSERS
ROCK DRILLS
TURBO BLOWERS
CENTRIFUGAL PUMPS
OIL & GAS ENGINES

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 11-929

ORIGINATOR OF MECHANICAL TAMPING

Specify DEPENDABLE

NORTHWESTERN

RAILWAY TRACK MOTOR CARS AND MAINTENANCE OF WAY EQUIPMENT

TYPE NO.	MODEL AND SERVICE
561 IHC 85	NORTHWESTERN 561-IHC 85 HEAVY DUTY EXTRA GANG CAR INTERNATIONAL 6 CYL. MOTOR, 85 H. P. — 8 TO 200 MEN.
581 85	NORTHWESTERN 581 85 POWER BALLAST DISCERS INTERNATIONAL 6 CYL. MOTOR, 85 H. P.
566 W	NORTHWESTERN 566 W — B & B GANG CAR WAUKESHA FC 4 CYL. ENGINE, 36 H. P. — 8 TO 100 MEN.
514	NORTHWESTERN 514 ALL SERVICE SECTION CAR NORTHWESTERN 8-13 H. P. ENGINE — 8 MEN.
534	NORTHWESTERN 534 LIGHT SERVICE SECTION CAR BRIGGS & STRATTON AIR COOLED ENGINE, 6.4 H. P. — 6 MEN.
532	NORTHWESTERN 532 LIGHT ALL SERVICE CAR BRIGGS & STRATTON AIR COOLED ENGINE, 6.4 H. P. — 4 MEN.
535	NORTHWESTERN 535 ONE MAN INSPECTION CAR BRIGGS & STRATTON AIR COOLED ENGINE, 6.4 H. P. — 1 OR 2 MEN.
538	NORTHWESTERN 538 ONE MAN INSPECTION CAR BRIGGS & STRATTON AIR COOLED ENGINE, 6.4 H. P. — 1 OR 2 MEN.
540DA	NORTHWESTERN 540 DA RAIL AND FROG GRINDER DOUBLE HEAD TYPE, WIS. 4-CYL. AIR COOLED ENGINE, 22 H. P.
544	NORTHWESTERN 544 SELECTIVE RAIL JOINTER SLOTTER RAIL JOINT SLOTTER & BEVELER — B & S AIR COOLED ENGINE, 6.4 H. P.
519	NORTHWESTERN 519 BALLAST CAR ALL STEEL CONSTRUCTION — 16 CU. FT. CAPACITY.
500A	NORTHWESTERN 500 A WORK CAR STANDARD WORK CAR — 6000 LBS. CAPACITY.
500A12	NORTHWESTERN 500 A 12 HEAVY DUTY WORK CAR HEAVY DUTY WORK CAR — 10,000 LBS. CAPACITY.
562AD	NORTHWESTERN 562 AD WORK CAR AND GANG TRAILER HEAVY DUTY STEEL FRAME TRAILER — 10,000 LBS. CAPACITY — 24 MEN.
504	NORTHWESTERN 504 LIGHT WEIGHT MOTOR CAR TRAILER FOR TELEGRAPH CREWS — WEIGHT 350 LBS. — CAPACITY 1000 LBS.
ENGINES	NORTHWESTERN SECTION MOTOR CAR ENGINES REPLACEMENT ENGINES — 8-13 H. P. WATER COOLED.
EQUIPMENT	REPLACEMENT WHEELS, AXLES AND BEARINGS FOR MOTOR CARS, PUSH CARS AND TRAILERS.

NORTHWESTERN REPRESENTATIVES

CHICAGO 5, ILL.
OTIS B. DUNCAN
37 W. Van Buren St.

NEW YORK 7, N. Y.
WALTER H. ALLEN
Room 107-E, 30 Church St.

BOSTON, MASS.
WM. B. JOYCE
P. O. Box 154
Beverly, Mass.

WASHINGTON 6, D. C.
W. NEWTON JEFFRESS
1731 K Street, N. W.

ST. LOUIS 3, MO.
WILLIAM J. ROEHL, INC.
1218 Olive Street

CLEVELAND 15, OHIO
C. E. MURPHY
923 Midland Bldg.

ST. PAUL 1, MINN.
GEORGE G. PREST
E-808 First Nat'l Bank Bldg.

OMAHA 2, NEB.
F. J. McDONOUGH
Cardinal Supply & Mfg. Co.
427 Sunderland Bldg.

NEW ORLEANS 12, LA.
W. J. CHURCH
308 Carondelet Bldg.

PITTSBURGH 19, PENNA.
J. A. EGBERT
Railway Products Co.
3605 Gulf Bldg.

SAN FRANCISCO 5, CALIF.
GEO. L. EDMONDSON
681 Market St.,
1036 Monadnock Bldg.

DENVER 2, COLO.
MILTON W. ALLEN
728 U. S. Nat'l Bank Bldg.

LOUISVILLE 6, KY.
M. M. DILLEY
Power Gates Company
116 S. Campbell St.

ATLANTA 2, GA.
SOUTHERN IRON & EQUIPMENT CO.
P. O. Box 2029

BIRMINGHAM 3, ALA.
H. G. MOUAT
544 Martin Bldg.

PORTLAND 4, ORE.
HARMER STEEL PROD. & SUPPLY CO.
138 S. W. First Ave.

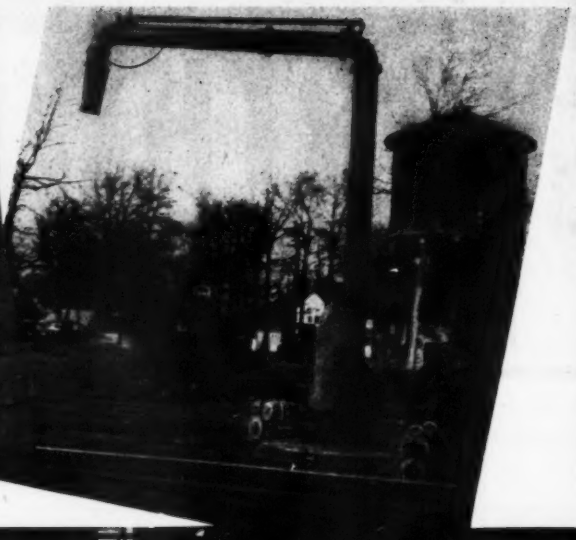
EXPORT AGENTS

NEW YORK 6, N. Y.
O. PHILIPP & COMPANY, INC.
19 Rector St.

WRITE FOR COMPLETE CATALOG CONTAINING PRICES AND SPECIFICATIONS ON NORTHWESTERN RAILWAY TRACK MOTOR CARS AND MAINTENANCE EQUIPMENT

NORTHWESTERN MOTOR COMPANY, EAU CLAIRE, WIS., U.S.A.

Pile of rubbish removed from 16" yard sewer



EXPERT PIPE CLEANING PAYS...

Dirt, lumber and pipe removed from 160 ft. of 18" sewer

The proper cleaning of water lines, drains and sewers has been the subject of study this year by a committee of experts of the American Railway Bridge & Building Association. Their findings were reported at the Association's recent annual convention, and are presented in the editorial pages of this issue.

This important subject is the business of Pittsburgh Pipe Cleaner Company. Through years of experience on countless railroad jobs, we have acquired the know-how and have developed the equipment to take care of every kind of pipe cleaning problem . . . better . . . faster . . . and more economically.

Our engineering service department will gladly furnish an estimate. Learn TODAY how expert pipe cleaning can speed up your water supply and reduce your maintenance costs.

An integrated engineering and operating service specializing in the cleaning of pipes of all kinds and all sizes.

HYDRAULIC AND MECHANICAL METHODS

WATER MAINS . . . PENSTOCKS . . . RISERS . . .
LATERALS . . . SEWERS . . . DRAINS . . .
GAS LINES . . . FUEL PIPES

- Reduce Pumping Pressures
- Speed Up Water Supply
- Increase Fire Protection
- Avoid Flood Damage

YEAR 'ROUND ATTENTION TO REQUIREMENTS

Let us show you how other railroads have reduced maintenance costs through our contract pipe cleaning service.

PITTSBURGH PIPE CLEANER CO.

133 DAHLEM ST. PITTSBURGH 6, PA.

PHILADELPHIA · BALTIMORE · WASHINGTON · NEW YORK · BUFFALO · CHICAGO · CINCINNATI · ST. LOUIS · DETROIT · BOSTON

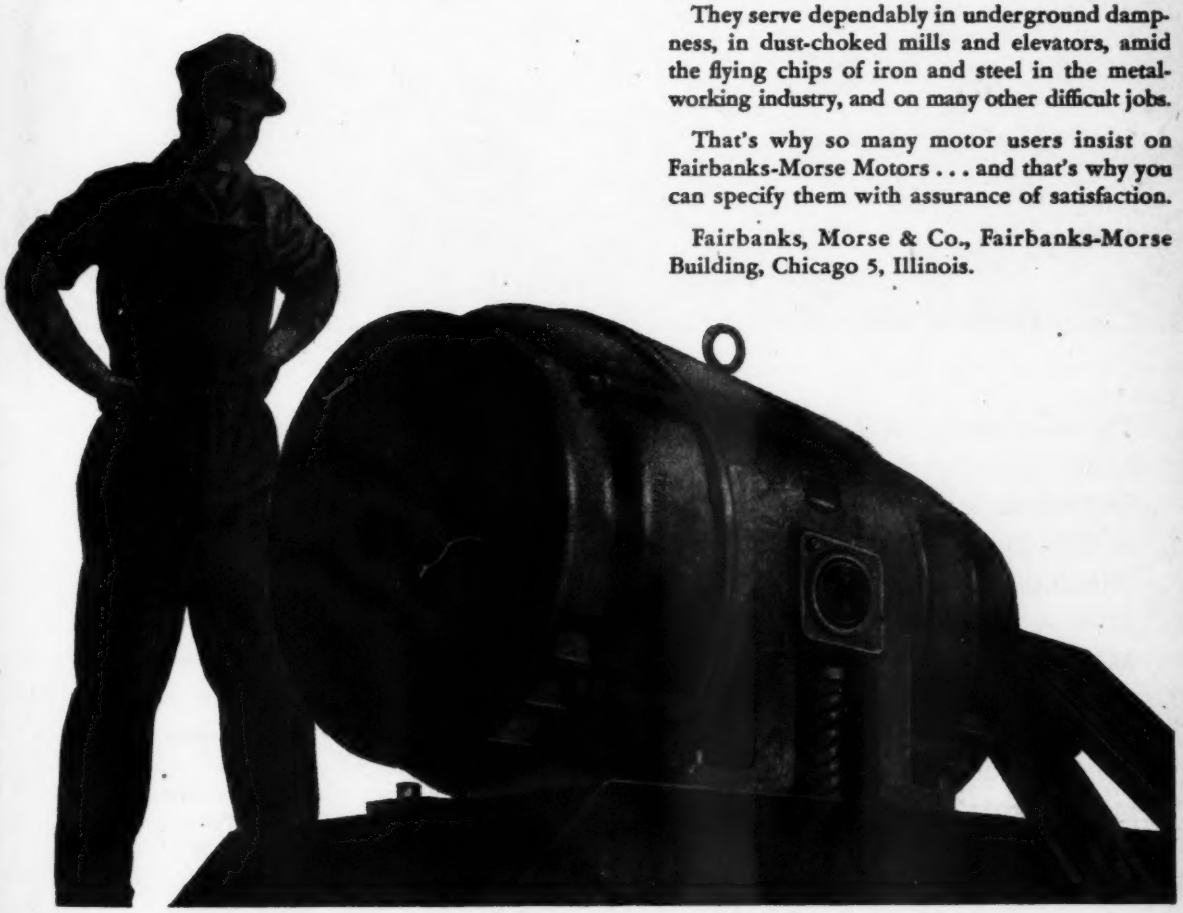
SEE FAIRBANKS-MORSE FIRST FOR MOTORS

CONSTANT research and development have contributed many features which make Fairbanks-Morse Motors outstanding. Today, they are an accepted standard in industry.

They serve dependably in underground dampness, in dust-choked mills and elevators, amid the flying chips of iron and steel in the metal-working industry, and on many other difficult jobs.

That's why so many motor users insist on Fairbanks-Morse Motors . . . and that's why you can specify them with assurance of satisfaction.

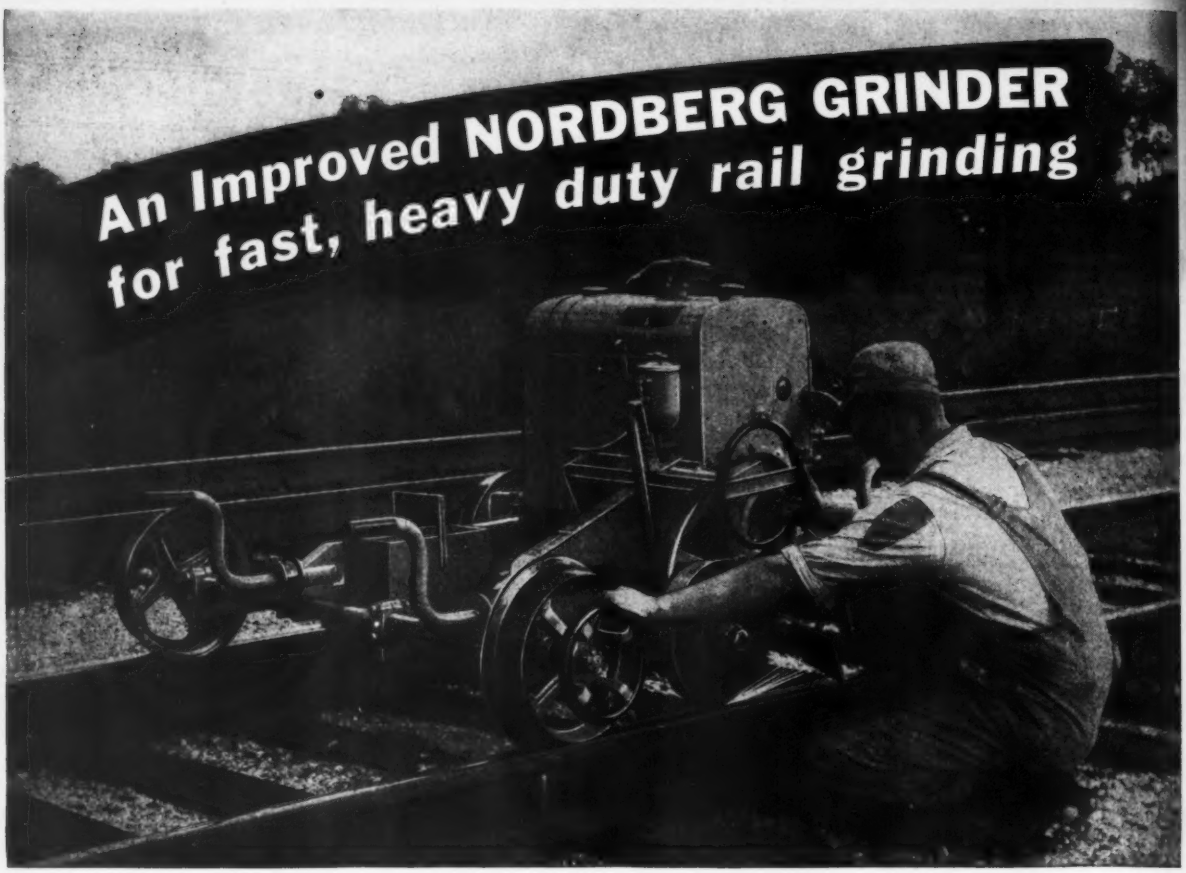
Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.



Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines
Scales • Motors • Pumps • Generators
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment



The new model WG Rail Grinder is a rugged, heavy duty, fast cutting machine with ample power for the heaviest work. It was developed specifically to meet the demands for a machine that would do grinding jobs faster — do them better and at less expense. The WG Grinder is the result of years of experience in building machines for every kind of grinding encountered in the maintenance of rail, switches, crossings, etc. In it has been incorporated the "know-how" Nordberg has gained during the many years it has supplied the machinery which now maintains the track of all major railroads. Write us for further information on how this and other types of Nordberg Grinders can be used for your grinding jobs.

Nordberg Developed These Tools For Your Maintenance Jobs

Spike Hammer
Cribex
Adzing Machine
Spike Puller
Rail Drill
Power Jack
Track Wrench
Rail Grinders
Track Shifter

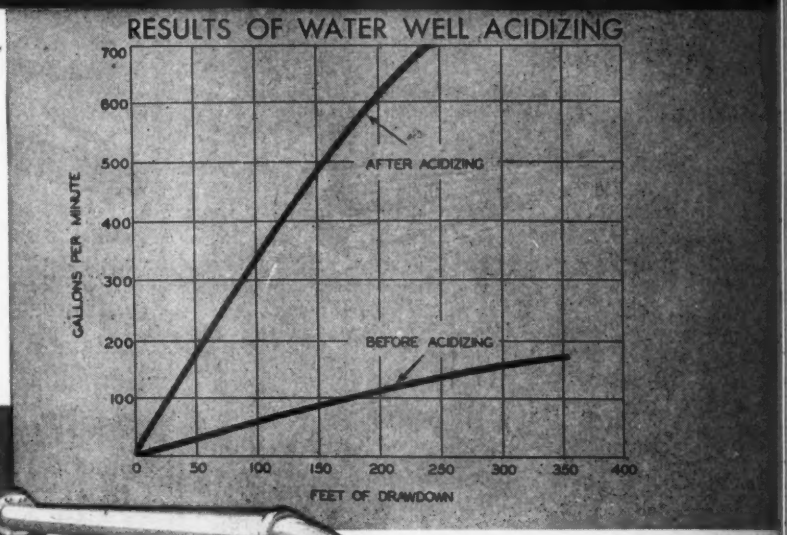
NORDBERG MACHINERY

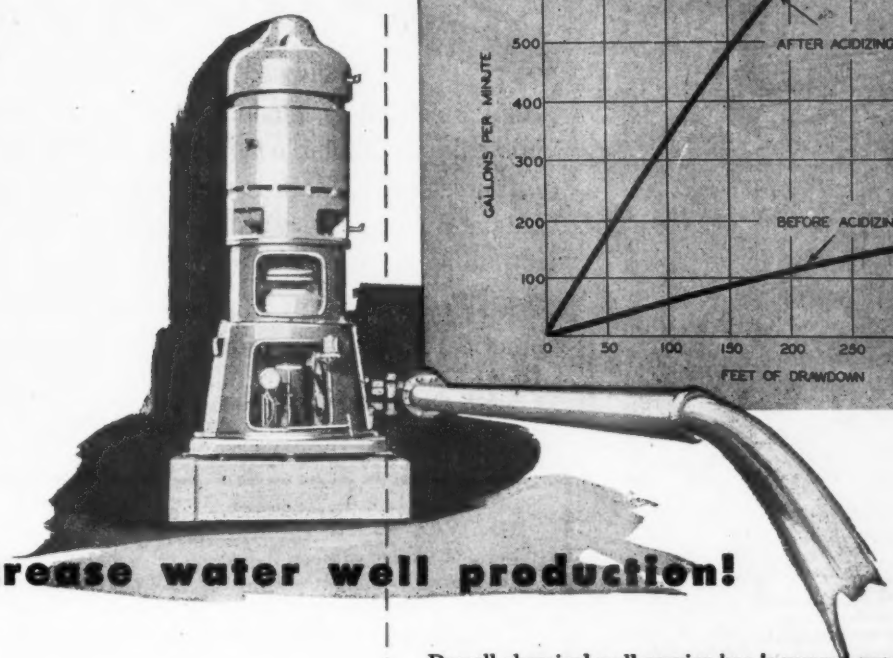
NORDBERG MFG. CO. MILWAUKEE WISCONSIN

Export Representative—WONHAM Inc.—44 Whitehall St., New York

DOWELL

Drawdown Curves showing the advantages to be obtained from proper chemical treating of water wells.





increase water well production!

Dowell chemical well service has increased production from thousands of water wells. The removal of retarding incrustations on screens and the enlarging of formation pores by chemical treatment permits more water to enter the well bore—and faster!

Dowell pioneered the well-acidizing field and its engineers have the know-how based on years of experience gained in treating thousands of wells. Ask Dowell to analyze your well—restore its production. Call the nearest Dowell office for a free estimate.

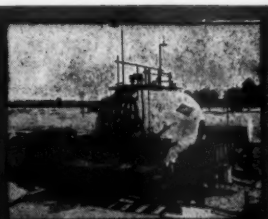
FREE SHOWING! Now available—a new 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. A Dowell representative will gladly arrange a special showing at your plant, office or organization meeting. Call or write Dowell today.

DOWELL INCORPORATED, TULSA 3, OKLAHOMA

Subsidiary of The Dow Chemical Company

New York • Philadelphia • Baltimore • Buffalo • Cincinnati • Cleveland • Chicago • Detroit
St. Louis • Houston • Kansas City • Wichita • Pittsburgh • Mt. Pleasant, Mich. • Salem, Ill.
Long Beach, Calif., Casper, Wyo.: Dowell Affiliate—International Cementers, Inc.

SPECIALISTS IN CHEMICAL CLEANING SERVICE

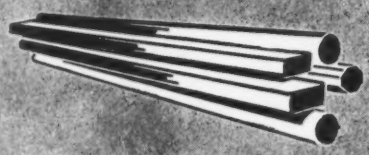


DOWELL

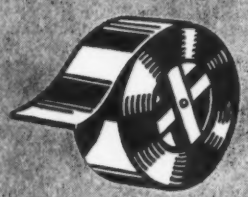
FOR INDUSTRIAL CHEMICAL SERVICE

BARGAIN PRICES ON

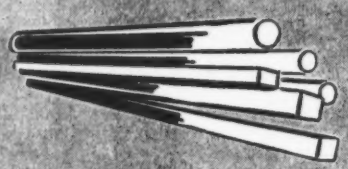
TUBING
Carbon, Alloy and some Stainless. Both Welded and Seamless.



TOOL STEEL
Water-hardening, Oil-hardening and High Speed Grades.



STRIP STEEL
Hot Rolled, Cold Rolled, Carbon, Alloy, and Stainless.



BAR STEEL
Hot Rolled and Cold Finished in Carbon, Alloy, and Stainless.

All steel is subject to priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area and then to purchase the material offered herein.

EXPORTERS: The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

NO WAITING FOR

HIGH GRADE

Steel

Alloy steel billets, blooms, bars, plates, are all immediately available through your War Assets Administration. Bars include rounds, squares, flats and hexagons. Suitable for substitute and re-rolling purposes.

Low prices on this high grade steel make it practical for low-cost products.

For complete information on steel send this coupon to your nearest WAA Regional Office:

TO: WAR ASSETS ADMINISTRATION

Please send me, without obligation, full information on the availability, condition and location of the following checked items:

1. Billets, Blooms, etc. ☐
2. Carbon and Alloy Bars ☐
3. Wire Rope and Aircraft Cable ☐
4. Stainless Steel Bars, Strips, and Sheet Standard Types ☐
5. Valves and Fittings ☐
6. Mechanical Tubing, Carbon, Alloy, and Stainless ☐

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....

157-8

WAR ASSETS ADMINISTRATION

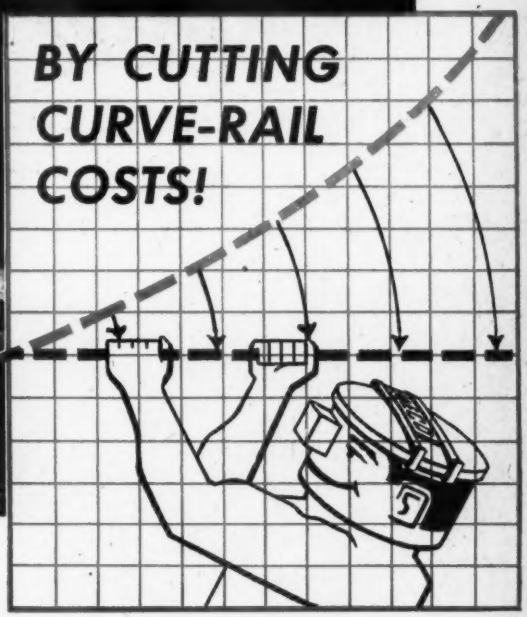
GOVERNMENT OWNED SURPLUS

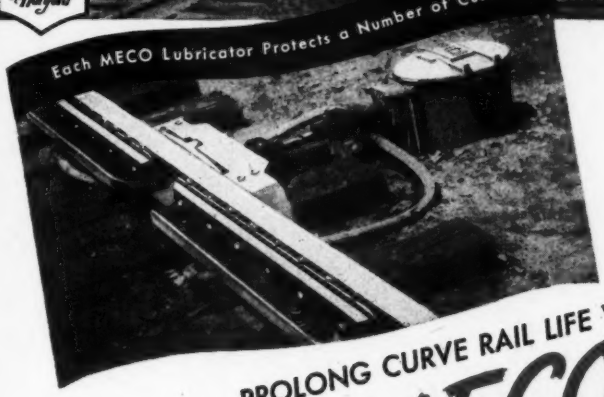
Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

157-8

Straighten Out The "Cost Curve"

Photo courtesy New York, New Haven and Hartford





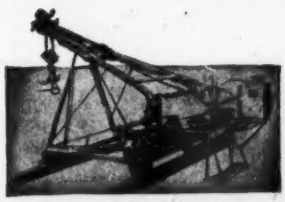
PROLONG CURVE RAIL LIFE WITH

MECO Lubrication

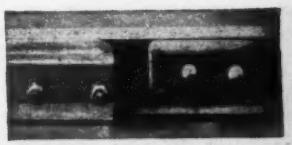
You get Twelve-fold Economy when you install MECO Lubrication: (1) Decrease curve friction. (2) Increase the life of present AND new curve rails two to four times. (3) Reduce wheel flange wear. (4) Increase Train Speeds on curves safely. (Ask us about the other eight.) The sooner you install MECO, the sooner your "curve-cost" curve straightens out!

★ Maintenance Equipment Company ★

RAILWAY EXCHANGE BUILDING • CHICAGO 4, ILLINOIS



Power Rail Layer Requires No Train Orders



Mack Reversible Switch Point Protectors Make switch rails last 8 to 10 times longer

COMPRESSION
Rail Anchors

NOWHERE is firmly-held track and uniform expansion more important than on bridges and viaducts. *Two-way* holding has won wide acceptance among bridge engineers. Compression Rail Anchors provide positive, economical protection on many vital railroad spans.

THE RAILS COMPANY

General Office
178 GOFFE STREET, NEW HAVEN 11, CONN.

ST. LOUIS, MO. HOBOKEN, N. J. CHICAGO, ILL.

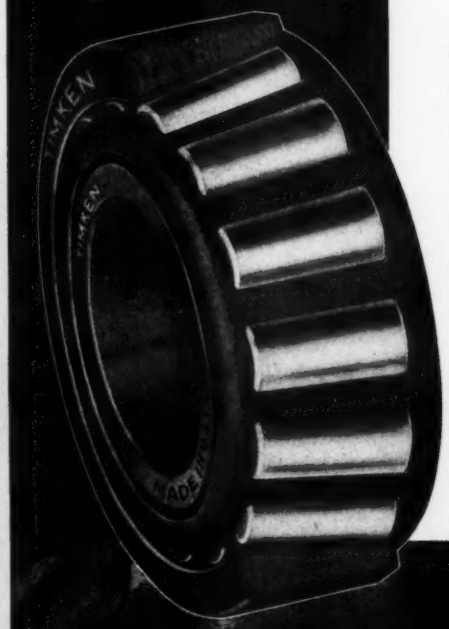
Keep 'em out of the shop-

ON THE ROAD with TIMKEN BEARINGS

When buying new section motor cars and trailers, specify Timken Tapered Roller Bearings, the same as used in America's modern passenger cars, locomotives and streamlined trains.

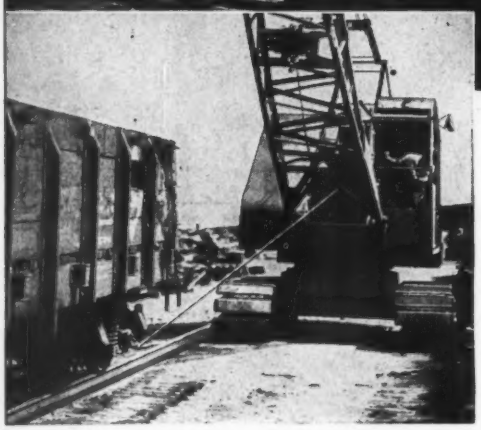
Then your equipment will be ready to roll at all times, secure against the threats of friction, radial, thrust and combined loads and requiring a very minimum of attention for lubrication and general maintenance.

Make sure of getting the full benefits of Timken Bearings by looking for the trade-mark "TIMKEN" stamped on every bearing that goes in your railcars. The Timken Roller Bearing Company, Canton 6, Ohio.



HANDLE STORES *Easily---* *Quickly--*

with your... LINK-BELT SPEEDER



Illinois Central's storekeeper at giant Markham Yard is enthusiastic about the way this LS90 Crane speeds up the many handling jobs in this huge rail center. Crawler mounted, it is not confined to rails, but gets about from job to job in a hurry. From loading or stacking rails, frogs and switches with a sling, to handling coal, scrap, or other loose material with clamshell bucket is a quick, easy change. Even spotting cars is a simple operation for this nimble, powerful machine. Speed, power, ruggedness and easy operation make Link-Belt Speeder "Shovel-Cranes" the favorite of railroad men, for construction, maintenance or yard work.

Ask for bulletin on the "Cargocrane," the wheel-mounted yard crane.

10,484

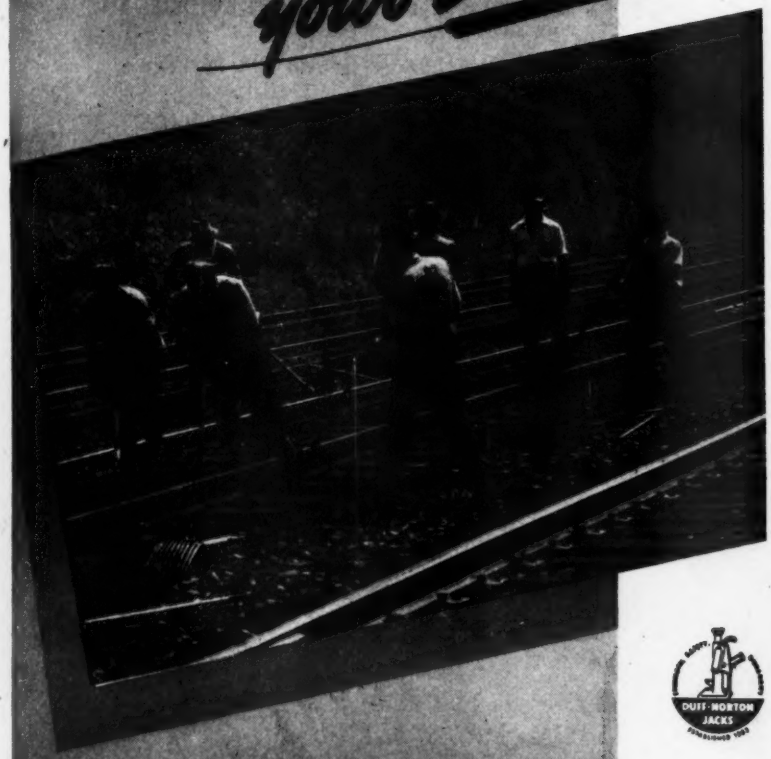
LINK-BELT SPEEDER

Builders of the Most Complete Line of
SHOVELS-CRANES-DRAGLINES

LINK-BELT SPEEDER CORPORATION, 101 W. PERSHING ROAD, CHICAGO 9, ILL.
A DIVISION OF LINK-BELT COMPANY

DUFF NORTON
GENUINE BARRETT
TRACK JACKS
your Best Bet for

DEPENDABILITY
EASY OPERATION
LONG SERVICE LIFE



There is a safe, dependable Duff-Norton Track Jack for every job. The Single Acting Jack illustrated at right is ideal for *section gangs* since their work consists mainly of surfacing and lining, requiring only a low lift. The Double Acting Duff-Norton Track Jack is ideal for *extra gangs*—the load is raised on both the upward and downward strokes of the operating lever for high speed lifting. Write for the complete Duff-Norton Catalog.

Duff-Norton Genuine Barret Track Jack No. 117—Single Acting

THE DUFF-NORTON MANUFACTURING COMPANY
PITTSBURGH, PA.
There is a Distributor Near You!

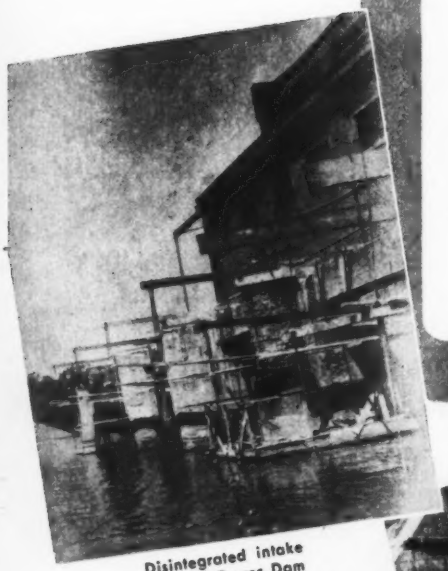
Detzel PRESSURE GROUTING

and "GUNITING" SERVICE *for . . .*

disintegrated concrete and masonry structures . . .

PIERS • ABUTMENTS • RAILROAD BRIDGES • RETAINING WALLS • DAMS • POWER PLANTS • STEEL ENCASEMENTS • LININGS FOR TANKS • TUNNELS • CANALS • DITCHES

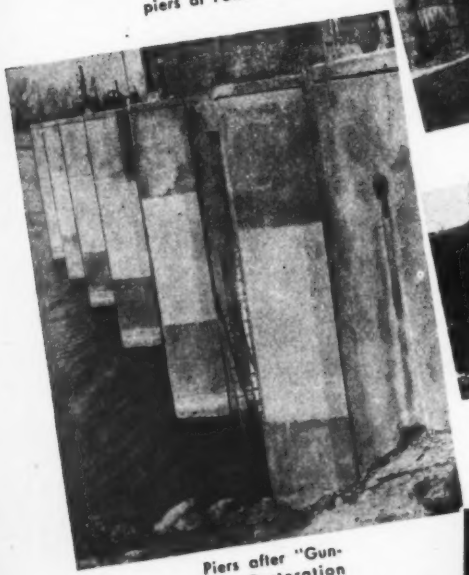
Years of experience, coupled with modern equipment, enable us to successfully handle any restoration job—large or small. Always under the supervision of an expert. Bound to give you satisfactory service.



Disintegrated intake piers at Power Dam

Condition of Bridge Wing Walls before starting work

After Restoration Service



Piers after "Gunite" Restoration

Note condition of disintegrated concrete Wing Wall at left

After Restoration Service

Let a Detzel Engineer Help You . . .

with Your Masonry Maintenance Problems

GEORGE E. DETZEL COMPANY

Pressure Grouting and Gunite Service

2303 GILBERT AVE. CINCINNATI 6, OHIO

IH Presents

Another advance in INTERNATIONAL DIESEL POWER

UD-14A

UD-18A

More Power! The horsepower of two models of International Diesel Power Units has been stepped up by 11% and 25% respectively —without increasing their size or weight— as the result of advanced engineering in the fuel combustion system. These are the 4-cylinder, 76-hp. UD-14A and 6-cylinder 125-hp. UD-18A Power Units. Power ratings are for *working* horsepower of the complete unit with fan, radiator and power take-off.

Greater Hang-on! When pulled down by overload, increased torque gives these Diesels greater "lug-ability." And they are built to take overloads in stride!

Better Operating Economy! Even with horsepower stepped up, these Diesels run cool under heavy loads and operate at new low cost per horsepower. A low rate of fuel consumption proves their efficiency.

Available Soon! Look for these newest International Diesels in the powered equipment soon available through your International Industrial Power Distributor. And ask him for the facts and figures on these models. He has them now.

Industrial Power Division

INTERNATIONAL HARVESTER COMPANY

180 N. Michigan Avenue • Chicago 1, Illinois

INTERNATIONAL IH INTERNATIONAL HARVESTER **Industrial Power**

RACOR
TRADE MARK REGISTERED

A Masterpiece

C. & N. W. RY. and C. M. St. P. & P. R. R. Crossing Intersection
Tower A-2, Western Avenue, Chicago

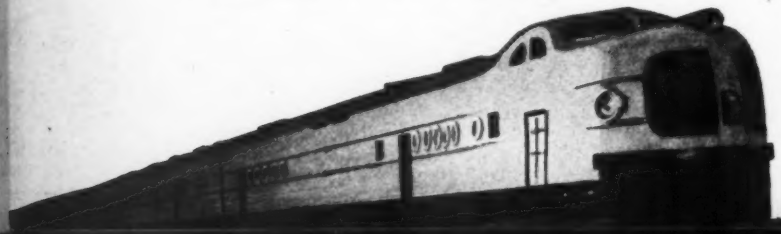
650 train movements every 24 hours

This unusual all RACOR installation is an excellent example of RACOR'S engineering ingenuity in the design and manufacture of special trackwork.

Tower A-2 crossing provides routing of all trains of each road over any of their four tracks with complete interchange facilities—in all, 650 train movements per day including through trains, freight movements and peak hour suburban service.

27 units installed in 25 consecutive days

Just eighteen months ago the engineering departments of both C. & N. W. and C. M. St. P. & P. railroads started plans for the renewal of track at this crossing to provide heavier construction, improved alignment and reduced maintenance. To minimize delays in traffic, each unit was completely preassembled on 7" x 9" creosoted ties with all plates, switch rods, switch machines, joint bars and bonding in place, ready to make a direct connection with adjacent units. Better than one unit a day was installed—an exceptional example of engineering efficiency—a salute to everyone participating in the construction, installation, and handling of traffic during this 36,413 man-hour project.

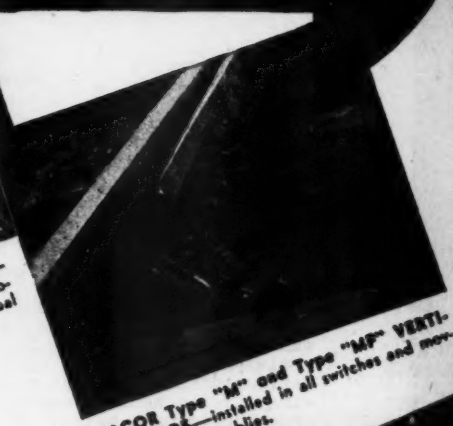


Chicago & Northwestern Ry. Streamliner
City of Los Angeles

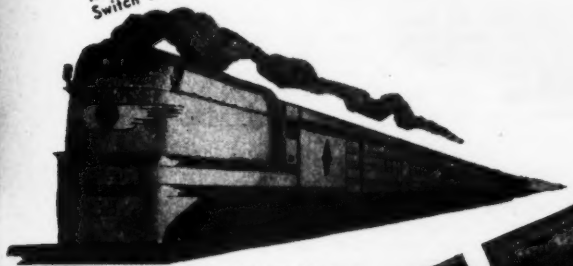
RACOR ENGINEERING
in special trackwork design

RACOR DOUBLE SLIP SWITCHES—all include RACOR Brace Rail Construction Type "M" and Type "MF" Vertical Switch Rods, and Samson Switch Points.

RACOR BRACE RAIL ASSEMBLIES—ties movable points and knuckle rails together as a unit, for control of individual creepage of parts.



RACOR Type "M" and Type "MF" VERTICAL RODS—installed in all switches and movable point assemblies.



Chicago, Milwaukee, St. Paul & Pacific R. R. Hiawatha

RACOR RAIL LUBRICATORS—installed on tracks approaching crossing, reducing wear on wheel flanges and curved portions of slip switches and turnouts.

RACOR SAMSON SWITCH POINTS—"V" shaped planing provides extra heavy point section which insures longer life of curved switch points through this heavy duty location.

RACOR MOVABLE POINT CROSSING—all include Racor Brace Rail Construction, Type "M" & "MF" Vertical Switch Rods.

PRODUCTS OF BRAKE SHOE RESEARCH

Only Ramapo has plants from coast to coast to expedite America's Railroad needs

NEW YORK, N. Y. • HILLBURN, N. Y. • NIAGARA FALLS, N. Y. • WASHINGTON, D. C. • ST. LOUIS, MO.
EAST ST. LOUIS, ILL. • SUPERIOR, WIS. • DENVER, COLO. • PUEBLO, COLO. • LOS ANGELES, CALIFORNIA
HOUSTON, TEXAS • SEATTLE, WASHINGTON • CANADIAN RAMAPO IRON WORKS, LTD., NIAGARA FALLS, ONT.

Ramapo's greater experience and facilities are ready to serve you

AMERICAN Brake Shoe COMPANY

RAMAPO AJAX DIVISION

American Brake Shoe Company • 332 So. Michigan Avenue, Chicago 4, Illinois

No. 215 of a Series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: "Keep Posted"

November 1, 1946

Dear Readers:

Many of you, no doubt, are concerned about the welfare of your industry. During the war, when the railways were bulging at the seams with business, there was no occasion or opportunity for such concern. Doing an essential job, the railways were then making a profit, as was every other industry called upon for maximum effort and peak production. Even with the end of the war, most of you visualized a healthy reconstruction era ahead for the railways. That it has not come should be a matter of concern to you. It has been to us on the staff of Railway Engineering and Maintenance.

But we are inherently optimists. We believe in the future of our country under our form of government; we believe in the essential need for and vitality of the railways; we believe in the ultimate good judgment of a correctly informed American public; and we are convinced of the fairness, loyalty and industry of informed railway officers and employees. At the same time, we emphasize that our confidence in the future of the railways is based on a correctly informed public and railway personnel.

The railways, it is true, are today faced with many problems – high taxes; heavily subsidized competition; stringent, inequitable regulation; and extremes in many classes of legislation, to mention only a few. Furthermore, and of the greatest consequence at the moment, they are being deprived of an adequate increase in freight rates to offset the huge additional expenses that have been placed upon them. Are you keeping informed on these matters?

Railway Engineering and Maintenance, dedicated as it is to the technical phases of your work, cannot hope to keep you fully informed on these broader problems of your industry, but considering these problems of such importance to your welfare, and knowing of your desire, we determined long ago to give you at least the basic facts monthly in our lead editorials. This has now been our practice for nearly fourteen years, and thus far this year we have discussed such matters as competition, public relations, railway profits, taxes, how to offset higher costs, and last but not least, in this issue, the "dirty deal" the railways are getting in the long delay of the Interstate Commerce Commission in granting them an essential increase in freight rates to offset their increased costs.

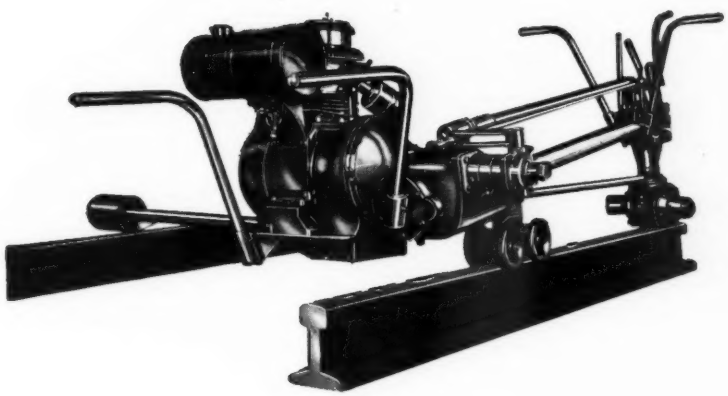
We hope you agree with our practice of discussing these matters frankly, and that you take time from your busy daily pursuits to give consideration to these discussions. To us, it is fundamental that you be correctly informed - It is fundamental to your industry.

Sincerely,

Neal D. Howard
Editor

NDH:bh

Soundly Engineered



Model B Raco Power Track Wrench

Great reserve power
Facility and smoothness of operation
Versatility
Speed
Convenient controls
Accurate automatic torque control
Floating balance of operating head
Automotive type construction
Highest quality steels
Simplified and logical design

Other Raco Machines:

Model A Raco Power Track Wrench
Raco Power Tie Borer
Everett Power M-W Drill

RAILROAD ACCESSORIES CORPORATION
CHRYSLER BUILDING • • • NEW YORK

Men and Machines MAKE PERFORMANCE ON THE JOB COUNT

The Engineer—Spearhead of Responsibility. All the vast equipment, maintenance effort, and executive direction of American Railroads focus on the steady hand and clear eyes of "the man at the throttle."

The tireless effort and ceaseless vigilance of a great maintenance corps stands behind the engineer as he climbs into his cab and throttles into action the carrier of priceless lives or precious merchandise.

Providing transportation for the men and materials of maintenance is a grave responsibility—one that Fairmont is proud to have discharged with satisfaction for more than thirty-five years.

Economical and safe to operate, the Fairmont A3-Series D gives a maximum of trouble-free service to the man behind the engineer.

FAIRMONT RAILWAY MOTORS, INCORPORATED
Fairmont, Minnesota

Fairmont Motor Cars

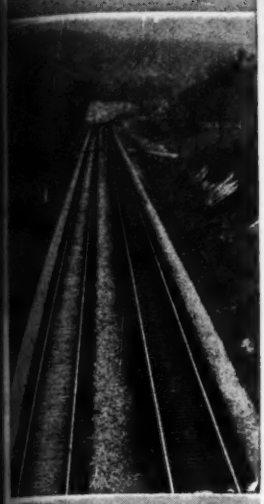
Capacity, Power and Comfort

Fairmont
RAILWAY MOTOR CARS

Performance ON THE JOB COUNTS

OF ALL THE CARS IN SERVICE TODAY MORE THAN HALF ARE FAIRMONTS

FAIRMONT A3-Series D, B&B and Extra Gang Car. A 17 horsepower engine and four-speed transmission give plenty of pull for big loads or steep grades.



Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

November, 1946

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

West Adams St., Chicago 3

NEW YORK 7, 30 Church Street

CLEVELAND 13, Terminal Tower

WASHINGTON, D.C., 4, 1081 National Press Bldg.

SEATTLE 1, 1033 Henry Bldg.

SAN FRANCISCO 4, 300 Montgomery St.

LOS ANGELES 14, 530 West 6th St.

DALLAS 4, 2909 Maple Ave.

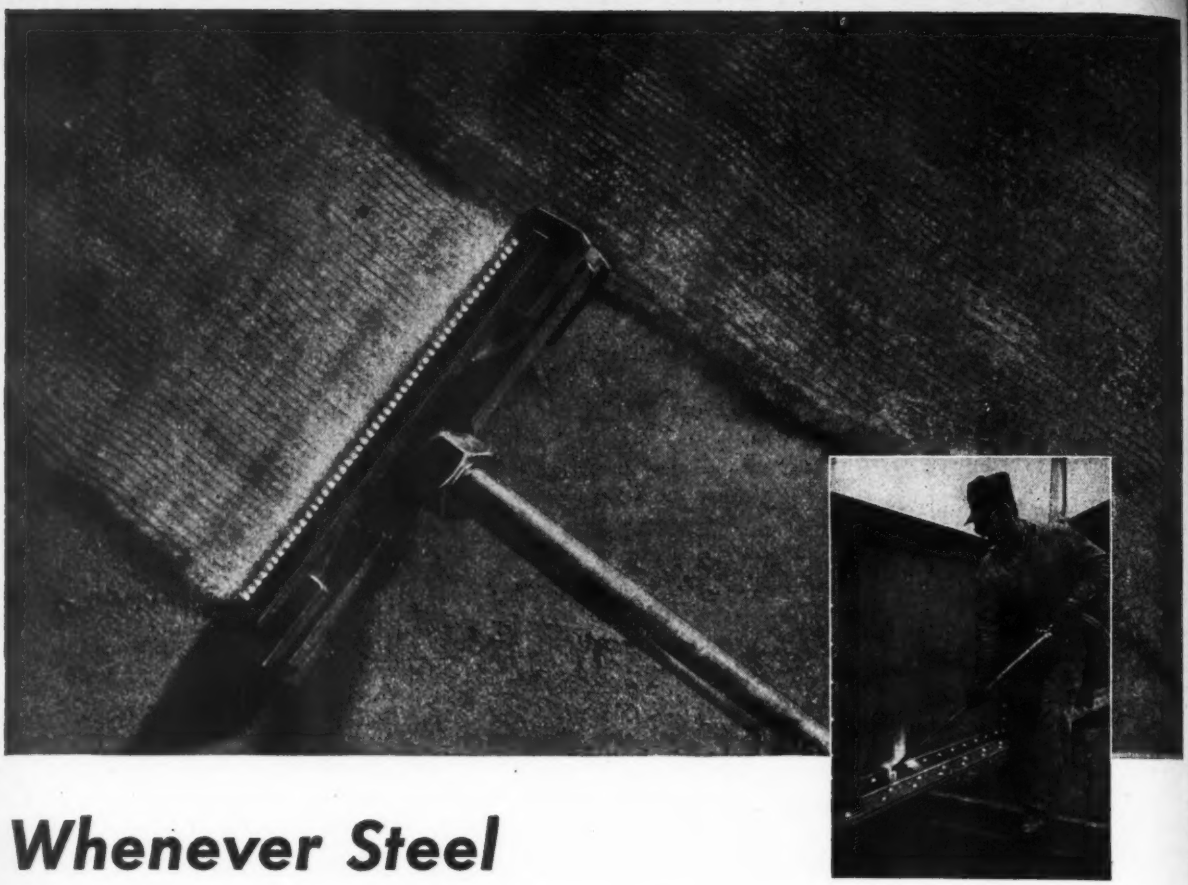
Samuel O. Dunn, *Chairman of the Board*; Henry Lee, *President*; Roy V. Wright, *Vice-President* and *Secretary*; Frederick H. Thompson, *Vice-President*; F. C. Koch, *Vice-President*; Robert E. Thayer, *Vice-President*; J. G. Lyne, *Vice-President*; H. E. McCandless, *Vice-President*; S. Wayne Hickey, *Vice-President*; C. Miles Burpee, *Vice-President*; John T. DeMott, *Treasurer*.

Subscription price in the United States and Possessions and Canada, 1 year $2, 2 years $3; other countries in Western Hemisphere, 1 year $5, 2 years $8; all other countries, 1 year $7, 2 years $12. Single copies, 50 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York 7, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.)

PRINTED IN U.S.A.

Editorials - - -



Whenever Steel Must be Dried or Cleaned

Use OXY-ACETYLENE FLAME-CLEANING

● Moisture, rust, and surface contaminants are quickly removed from iron and steel surfaces with the high-temperature oxy-acetylene flames produced by Oxweld's flame-cleaning equipment.

These flames consume or neutralize oil, soot, old paint, and other foreign matter that may be present. They evaporate all traces of surface moisture. And they cause the rust and scale to expand and pop off, leaving a clean, warm, and dry surface on which paint will spread evenly and bond tightly.

Oxweld's flame-cleaning equipment can be maneuvered to clean thoroughly and quickly corner angles, riveted areas, and irregular shapes, as well as flat and round surfaces. This equipment can be used to clean all types of structural steel—bridges, train sheds, station buildings, pipe, tanks, rolling stock, and steel work inside tunnels. Ask an Oxweld representative for information regarding a demonstration.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
Carbide and Carbon Building Chicago and New York
In Canada:
Canadian Railroad Service Company, Limited, Toronto

OXWELD RAILROAD SERVICE

SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

Railway Engineering and Maintenance

Increases—

Why For All, Except the Railways?

The railways of the country, including the railway of every officer and employee who reads these comments, have been and continue to get a "dirty deal." This is putting it in blunt, everyday, readily understood language, but considering the long and continuing delay in granting them the increase in freight rates which they seek to offset huge increases in expenses, it is the simple truth.

Early in the year, confronted with large increases in wage rates and in the price of everything they must buy, the railroads petitioned the Interstate Commerce Commission for an average increase in freight rates of 19 per cent. On July 1 they were granted a temporary or interim increase of 6½ per cent, but delay in allowing the increase requested continues as though it were a matter of small consequence.

If this delay were a matter for concern alone to a few railroads and their owners, it would be bad enough, but, on the contrary, it is a matter of concern to every railroad, every owner of a railroad security, and every railroad employee. Indeed, it should be a matter of concern to all American industry and the public generally, that through artificially restricted earnings, the war-time vitality of the railroads is being sapped and their peace-time service to the country placed in jeopardy.

While not putting the situation quite as bluntly as in the foregoing, a recent issue of Train Talks, a magazine published by the Pennsylvania Railroad for distribution to its patrons and stockholders, says substantially the same thing, with enlightening elaboration of the facts that should be in the hands of every railroad employee and every thinking American citizen. Following are some of its comments:

"The railroads alone, among the great industries of the nation, have been denied adequate relief in meeting the higher costs thrust upon them by the war and its aftermath, and in spite of the fact that, actually, freight rates were slightly lower at the close of the war than at its beginning.

"The increases which the railroads are now seeking average only eighteen one-hundredth of a cent for carrying a ton of freight one mile.

"Three increases since 1939 have raised wages 51.1 per cent, an amount that will take an extra $1,451,000,000 a year to meet alone—more than $3,900,000 a day.

"Materials and supplies today are costing the railroads far more than in 1939, which means a half-billion dollars more a year in expenses.

"The emergency increase of 6½ per cent in freight rates allowed will produce a little more revenue, but will still fail by $1,865,000 a day to meet increased costs of operation and provide means to satisfy the nation's need for a continually prospering and improving railroad system.

"The railroads are doing a peak business, and, as in all periods of peak business, should be making peak profits in order to keep pace with the country's growth.

"The railroads are meeting their responsibility to the country, but the country is not meeting its responsibility to the railroads."

And finally—"It all sums up to the simple economic fact—that the money to pay the higher wages granted railroad employees . . . . to pay the higher prices for materials . . . . to pay federal, state, county and local taxes . . . . to pay for the repair of the tremendous wear and tear of the war years . . . . and to pay for improvements and

modernization . . . . simply cannot be earned at present freight rates."

How are the railroads doing without the relief they need in increased freight rates? The record for the first eight months of this year tells the story. In these eight months, according to the Bureau of Railway Economics of the Association of American Railroads, the Class I roads had an estimated net income, after interest and rentals of $55,400,000, compared with $443,932,588 in the corresponding period of 1945. The eight-months net railway operating income, before interest and rentals, was $298,401,456, compared with $735,012,867 in the same period of last year. Furthermore, 56 Class I railroads failed to earn interest and rentals in the first eight months of 1946—of which 25 were in the Eastern district of the country, 11 in the Southern region, and 20 in the Western district.

Not fully aware of these facts, it is not surprising that many employees, many business men, and the public generally cannot understand why the railways are not flourishing in the new peacetime era, especially in the light of the heavy traffic they are still handling, both passenger and freight.

Winter—

A Mild One Hoped for, But—

MAINTENANCE men in territories subject to snow troubles are hoping fervently for an open winter. Severe winter weather, particularly if it is accompanied by heavy snowfall, has always been a headache for the track man, but in periods when it is impossible to obtain extra help in the quantities needed during snow storms, a headache is a mild annoyance compared to the severity of the problem then produced. During the war years the reserve pools of labor that the railroads had theretofore been able to draw on for the extra man-power required to fight snow, practically disappeared, and indications are that they have not made their reappearance in anywhere near the magnitude of the pre-war years.

While the probability is that the railroads will always need at least some extra help during snow storms, particularly at large terminals and important interlockings, they have learned much through the hard experience of the war years about fighting snow with a minimum of man-power. Specifically, they have learned that the regular forces, if properly organized and carefully schooled in the procedure to be followed during storms, and if completely equipped with modern snow-fighting machines and appliances, can frequently cope with all but extremely severe storms, and even then will reduce the need for extra man-power to a minimum. Another aspect of this matter—and one of increasing importance at this time—is the reduced cost involved if emergencies are handled with available forces.

Maintenance supervisors, therefore, have a double incentive to lay careful plans for fighting snow this year. While hoping for a mild winter, they know from experience that the only safe procedure is to plan for the worst. Consequently they will want to make certain that their snow-fighting organization is complete in every detail, with each man fully aware of the role he is to play; that switch heaters are in place and ready for instant use; and that all other tools and equipment employed in fighting snow are in useable condition.

Finally, in the knowledge that mechanized equipment constitutes one of the most economical and effective means of handling snow, those responsible for keeping the tracks and other properties open during and following winter storms will want to ascertain that they are prepared to use all available equipment to full advantage. Such equipment not only includes machines like snow plows, that are designed specifically for disposing of snow and ice, but those other machines, such as weed burners, bulldozers, tractor-drawn scrapers, power shovels, etc., that can be readily adapted to this work, even though they may have been acquired with other tasks primarily in mind.

Supervision—

Are the Railways Providing Enough?

IT has often been said and never denied that supervision is the cheapest thing the railways pay for. The truth of this adage was demonstrated time and time again in recent years while labor was so scarce and when much of that which could be obtained was so lacking in effectiveness. It is still being demonstrated today, since the quality of labor available for many classes of work remains considerably below pre-war standards.

Probably no road has ever provided the optimum of supervision for its maintenance forces, although over a long period, ending with the late Twenties, a few had built up their supervisory forces to the point where they were beginning to approach this optimum. Then came the depression and, by force of circumstances, the whole development collapsed, many supervisory officers were demoted, the territories of those that remained were extended, often beyond the ability of any man to give them detailed attention, and in many instances supervision retrograded to the point where it was poorer than at any time within memory. While some phases of this situation have been corrected, much still remains to be done on many roads or territories before supervision is restored to the place it held 20 years ago. And from there it is still a long way from the place it should occupy.

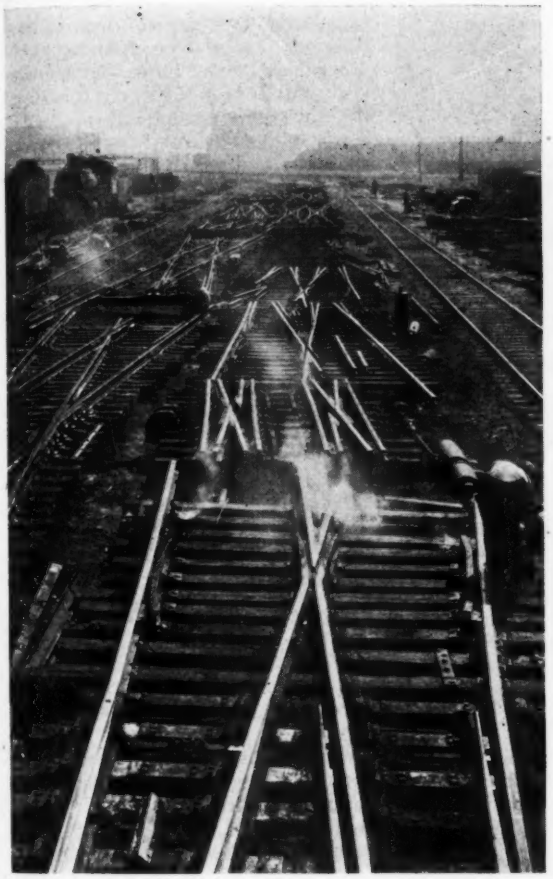
This raises the question of how much territory should be given to a supervisor or roadmaster and how many gangs he can look after effectively and economically. This, in turn, leads to the question of how many men and how much work a general foreman can supervise successfully; and how many men can be handled by a foreman, and by an assistant foreman.

While it is not possible for anyone to state categorically how much territory a supervisor can manage successfully or how many men a foreman can handle effectively—and safely—more care should be exercised in determining the answer to these questions than is sometimes in evidence, to insure that neither supervisors nor foremen are so burdened with territory or forces, or both, that it is beyond their ability to oversee them properly.

Big Special-Trackwork Job Goes in Smoothly

By T. H. BEEBE
Chief Draftsman, Chicago & North Western

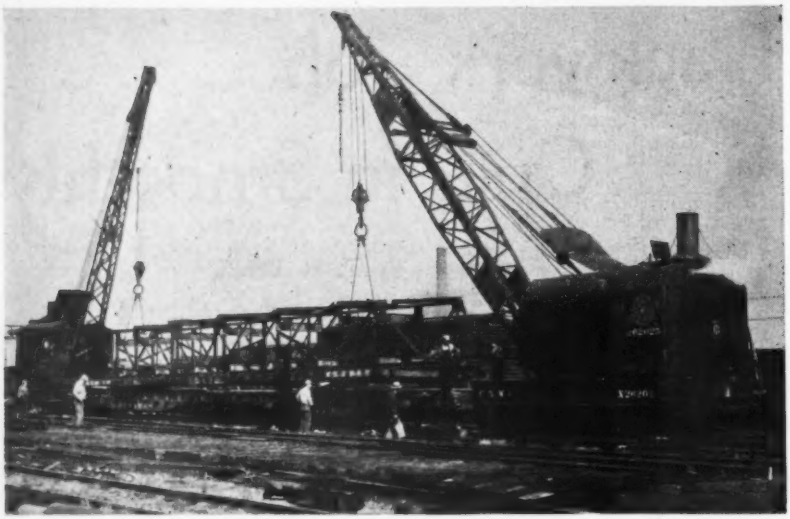
This article, presented originally as an address on September 19 before the annual meeting of the Roadmasters' and Maintenance of Way Association at Chicago, gives essential details of a project involving the installation of 27 units of special trackwork at an important crossing at Chicago of the North Western and the Chicago, Milwaukee, St. Paul & Pacific. Interesting aspects of the undertaking included complete preassembly of the units and their installation with the aid of a special lifting arrangement employing a secondhand truss span 86 ft. long.



Above—Some of the Units of Special Trackwork, Completely Assembled in a Yard About One-Half Mile From the Crossing. Below—An Old, Out-of-Service Steel Truss Foot Bridge Was Used as the Stiffening Member in Moving Each Unit from Assembly Point to Point of Installation

T. H. Beebe

AN INTERESTING installation of pre-assembled special trackwork was made recently by the Chicago, Milwaukee, St. Paul & Pacific and the Chicago & North Western at the crossing of their main lines near Western avenue and Kinzie street in Chicago. This location is about three miles west of the respective passenger terminals of these roads, and is situated between these terminals on the one hand and the passenger-train yards and engine-terminal facilities of the two roads on the other, with the result that, in addition to the regular train movements, there are many backup and switching movements between the yards and the passenger stations.



Picking Up a Completely-Assembled Double-Slip Switch and Setting It on Two Flat Cars for Movement to Point of Installation

All passenger trains of the Milwaukee, including its Hiawathas, pass over the crossing, as well as all through trains of the North Western to Omaha, Denver and the Pacific coast, including the Streamliners and the Challengers. In addition, both roads maintain a heavy suburban service between downtown Chicago and the western metropolitan area, resulting in peak movements over the crossing during the morning and evening hours. Although the traffic consists predominantly of passenger trains and passenger-train equipment, there are a considerable number of freight and interchange movements, participated in by the Pennsylvania, the Baltimore & Ohio, and the New York Central. The average number of movements over the crossing in a 24-hr. period is 650, of which about 500 are in the 13-hr. period between 6:00 a.m. and 7:00 p.m.

The crossing, which is at grade, cosists primarily of a Milwaukee four-track system intersecting a North Western four-track system at an angle of 8 deg. 10 min. 16 sec. It includes the necessary double-slip switches, turnouts and crossovers to facilitate the routing of trains by each road over any of its tracks; for complete interchange facilities; and, in the case of the North Western, for handling movements in and out of the eastern end of its California Avenue coach yard, immediately west of the crossing, for turning movements on the east end of its Rockwell Street wye, also west of the crossing, and for a minor portion of freight movements to and from the industrial and interchange district on the south and southwest sides of Chicago.

The present track arrangement was installed a little over forty years ago. In the recent project, the trackage replaced consisted of 100-lb. rail, section 10035, which was installed in 1925, thus having a service life of 21 years. It is interesting to note that the 90-lb. material that was in service prior to 1925 was in place 20 years.

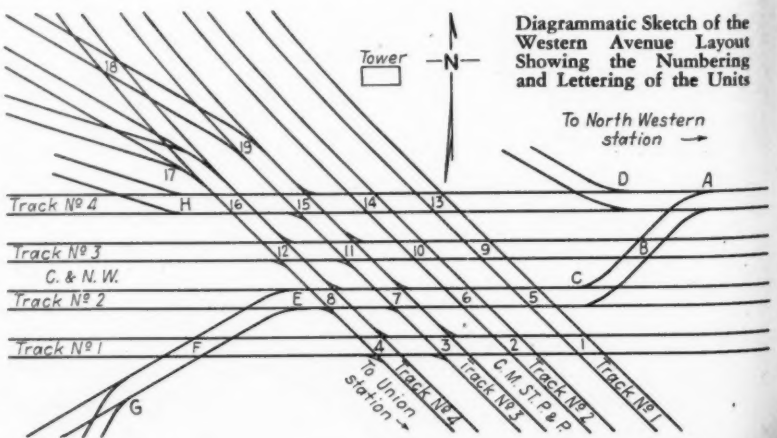
Preliminary Planning

Tentative plans for the renewal of the special trackwork at the Western Avenue crossing were made by representatives of the engineering departments of the North Western and the Milwaukee some eighteen months ago. A joint engineering survey was made of the existing track layout, and a large-scale plan was prepared. Based on a study of this plan, the decision was reached to preserve the original alinement of both roads on 13-ft. track centers, with certain exceptions. The alinement was made tangent through the crossing except for certain portions of the Milwaukee's freight mains (Tracks No. 3 and No. 4), which are on 12-deg. 30-min. curves through five units, two of which are double slips. The track centers of these mains at the westerly end of the plant were changed from 13 ft. to 15 ft., which required a curvature of 3 deg. 11 min. through a rigid-frog crossing. Another decision was to use the Milwaukee's rail section (13128) for all of the trackwork, except for one No. 10 double-slip switch and four turnouts, exclusively in C.&N.W. trackage, where the 11228 rail section was used.

In the crossing system proper there are 19 units, consisting of 8 No. 7 movable-point crossings, 7 No. 7 double-slip switches, 2 rigid frog crossings, a lap turnout (No. 17 on the diagram) and a special turnout with leads curving in opposite directions, not equilateral (No. 19). In addition, the North Western renewed a No. 7 double-slip switch and 2 No. 7 turnouts with 13128 material. Of the 27 units enumerated, the Milwaukee maintains 4 No. 7 movable-point crossings, and the North Western the remainder, 10 at its own expense and 13 at joint expense.

Trackwork Improvements

Plans were prepared on the basis of the established alinement, and the dimensions computed carefully. A number of improvements were incorporated in the design of the No. 7 double-slip switches, including a uniform curvature of 11 deg. 2 min. between the points of switches, compared with 15 deg. in existing plans. Also, the gage was widened to 4 ft. 8⅞ in. between points of switches, and the angle at the point of switch was reduced to 1 deg. 18 min. by the use of 14-ft. curved points, which are housed to maintain a uniform gage line, with a heel spread of 6⅜ in. on the straight side and 6⅝ in. on the curved side. All switches are of the Samson type with under-cut stock



Diagrammatic Sketch of the Western Avenue Layout Showing the Numbering and Lettering of the Units

rails, and the switch rods in all switches and movable-point assemblies are Type M and Type MF vertical rods. The movable center points were designed to be used interchangeably in the double-slip switches and in the movable-point crossings. The present brace-rail assemblies were designed by the manufacturer to bind to movable points and the knuckle rails together as a unit and to control creepage of the parts, improving the usual anchorage device. To reduce curvature and lead lengths and to provide interchangeable material, the 14-ft. curved switch design was also used in seven turnout units.

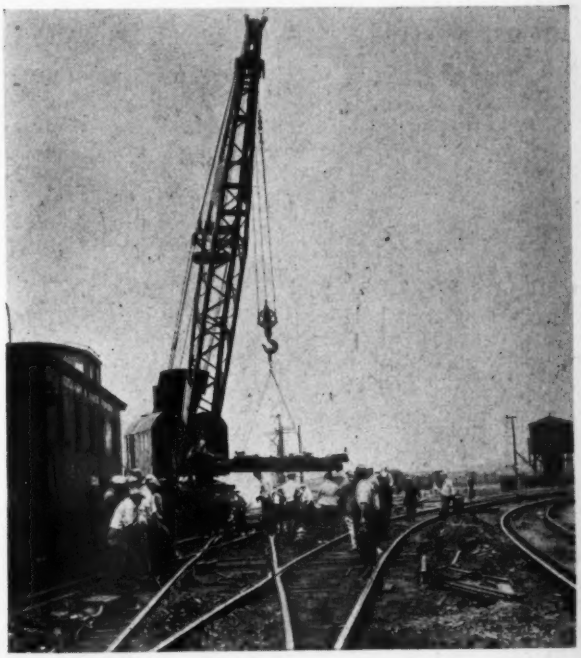
Because of the many routes involved, a large number of insulated joints was required, the locations of which were carefully established by the signal departments of the two roads with the objective of keeping the dead space in track circuits to a minimum. Allowance was made for the end posts of the insulated joints in computing rail lengths. New switch machines were furnished and installed on each unit as it was assembled, and upon completion of the assembly, but prior to installation, the operation of the machines was thoroughly tested.

Decide on Pre-Assembly

In view of the difficult problem posed by the heavy traffic moving over the crossing, joint meetings were held by the operating and engineering officers of the two roads to determine a method of installation and a procedure which would minimize traffic delays. As a result it was decided to completely assemble the units out of track at convenient locations close to the crossing. A schedule was prepared covering the installation of the 27 units in 25 consecutive days. A diagrammatic plan of the crossing was prepared, on which each of the Milwaukee and joint units was identified by number and the North Western units by letter. A white print of this plan was then made and colored for each of the 25 days' operations. On each day's plan the unit to be placed on that day was colored in red —meaning that the trackage involved was out of service—and the adjacent trackage which would be temporarily used at intervals by work trains was colored yellow. Copies of these plans were furnished to the operating departments for their use in re-routing traffic and to the engineering officers in charge of the field work. On two of the days the Milwaukee and the North Western each placed a unit in the same track.

The Milwaukee's four units were assembled in a yard that this company has northwest of the site, and the North Western assembled 18 units in a yard it has approximately 1,000 ft. west of the site. The remaining five North Western units were assembled in available space immediately adjacent to their final locations. Each unit was completely assembled on 7-in. by 9-in. creosoted ties, with all plates, switch rods, switch machines, joint bars and bonding in place, so that when a unit was set in final position the only remaining steps required were to make the end connections, and connect the control wires and air to the electro-pneumatic switch machines. In assembling the double-slip and movable-point, the knuckle rails were lined with a transit to insure that the center of each knuckle would be at right angles to the long diagonal of the unit. This was necessary because all of the units were designed and fabricated to make direct connections with adjacent units, and any variation would adversely affect the joint-gap allowance. In assembling the curved crossings and all of the turnouts, the theoretical curvature was established by transit to avoid irregularity of alinement when installation was made. Through careful instrument work, no difficulty was experienced in making connections with new units, even though in some cases it was necessary to place a new unit between new units previously installed.

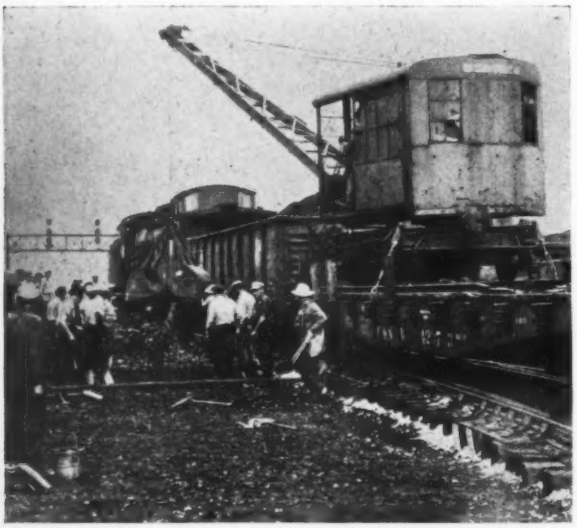
To make certain that there would be no distortion of the assembled units in handling from the point of assembly to the final position in the track,



Lifting Out Old Double Slip, One Third at a Time, and Stacking the Units on a Flat Car for Removal

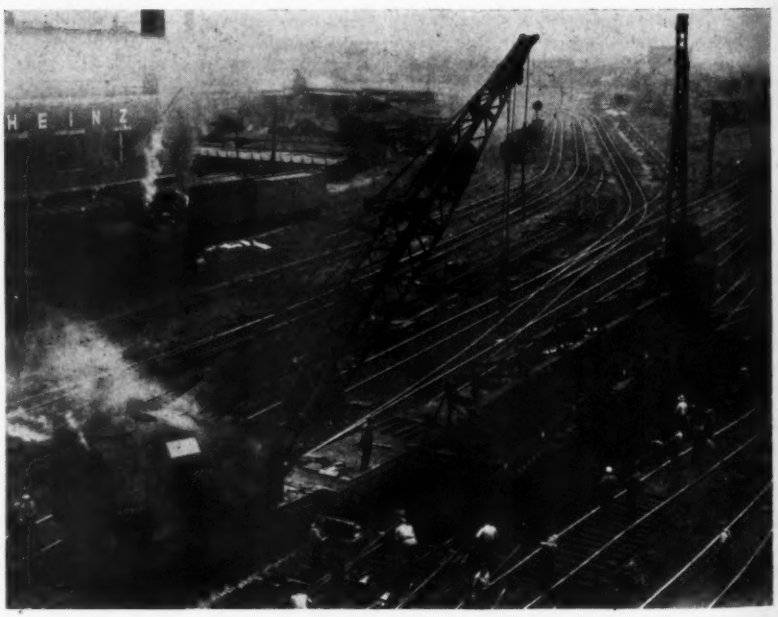
Below—As Soon as Old Slip Was Out, the Old Tie Bed Was Cut Down About Four Inches, Using Hand Picks and Barco Power Hammers

and to enable the assembled units to be accurately placed with no temporary blocking between the bottoms of the ties and the tie bed, a special method of handling the units was devised which fulfilled both of these conditions. As one of the assembled No. 7 double-slip units, complete with switch machines and ties, was 82 ft. long, exclusive of the attached stock rails, and weighed 42 tons, a rigid lifting arrangement of considerable length was needed. To meet this requirement a secondhand riveted span, consisting of two trusses 6 ft. in depth, 86 ft. in length, and spaced 5 ft. 6 in. center to center, with reinforced cross connections, was used.



Assembled in Piles, the Old Ballast Was Loaded Out With a Burro Crane Equipped With a Clamshell Bucket

Below—Two Brownhoist Cranes Setting a New Double Slip as a Unit on the Newly-Prepared Tie Bed



The Lifting Arrangement

In arranging the lifting device, a number of switch ties were placed transversely on top of the unit to be handled and the truss frame was set on top of these. The switch ties were spaced 13 ft. 10 in. apart, being placed to fall under alternate panel points of the truss frame. A temporary supporting rail was then placed transversely under the unit rails between the ties at the location of each of these switch ties, and the truss was attached to the unit by wrapping a heavy chain around each of the supporting rails and the bottom chord and floor beam above it. The slack was taken out of the chains with wood wedges. Each unit was lifted by a locomotive crane at each end, attachment being made to the top chords by the conventional bridle to hold the unit level, and was loaded on two empty flat cars placed between the cranes. The unloading was a reverse procedure after movement to the point of installation by work train. This part of the work was handled by a steel bridge erection crew.

The sequence of each day's work was as follows:

(1) Final cleaning of the cribs of the unit to be changed was carried out by a track crew of approximately thirty men, starting at 7:00 a.m.

(2) At 8:30 a.m., or somewhat later, the track involved was turned over by the operating department, at which time the old unit was cut into three sections with oxy-acetylene torches, and a work train, including a locomotive crane and an empty flat car, was moved in on an adjacent track and the cut sections loaded. This operation usually consumed about fifteen minutes.

(3) The old tie bed was broken up with hand picks and mechanical tampers equipped with bull points, and was excavated to a depth of four inches below the bottoms of the old ties. The excavated material was temporarily piled wherever it would not interfere with traffic. This operation consumed considerable time, due to the limited number of men who could be worked in the area and the hard compaction of the old tie bed, being completed usually between 12:00 and 12:30 p.m. At the same time, the ends of any of the old ties which would interfere with the placing of the new unit were sawed off with a power chain saw.

Setting the New Units

(4) The new unit, loaded as stated on two flat cars between two locomotive cranes, was brought up by work train and set in place to accurate location determined by transit. This operation consumed 25 to 30 min., a considerable part of this time being used in getting the unit accurately placed.

(5) The end track connections were made, along with the signal and air connections to the new unit. Short batter connecting rails were furnished with the units for connections to the old 10035 rail sections, and these, together with the standard compromise and insulated joints needed, were brought in fastened temporarily to the unit ties. The use of batter rails was desirable to permit the installation of insulated joints in their final location, and in all cases the old rail was cut back to permit their insertion. This practice eliminated any cutting

In Place, the New Double Slip Is Being Coupled Up, While the Signal Forces Hook Up the Electro-Pneumatic Switch Machines

of the new rail. Power rail drills and power bonding drills were used where necessary in making the connections. This phase of the work usually consumed from 30 to 40 min.

(6) New stone ballast, along with a Burro crane mounted on a flat car for unloading it, was brought up by work train, and sufficient ballast for temporary surfacing was unloaded on the unit, which was then raised and tamped to surface, and the track restored to service between 4:00 and 5:30 p.m.

(7) Track forces cribbed out the old unit to be replaced the following day, and bridge forces fastened the lifting arrangement in place on the next new unit to be installed.

The old ballast was loaded at opportune times by locomotive crane or by casting it over the retaining wall into trucks on the street below, this being Western avenue which is carried under the tracks in an underpass.

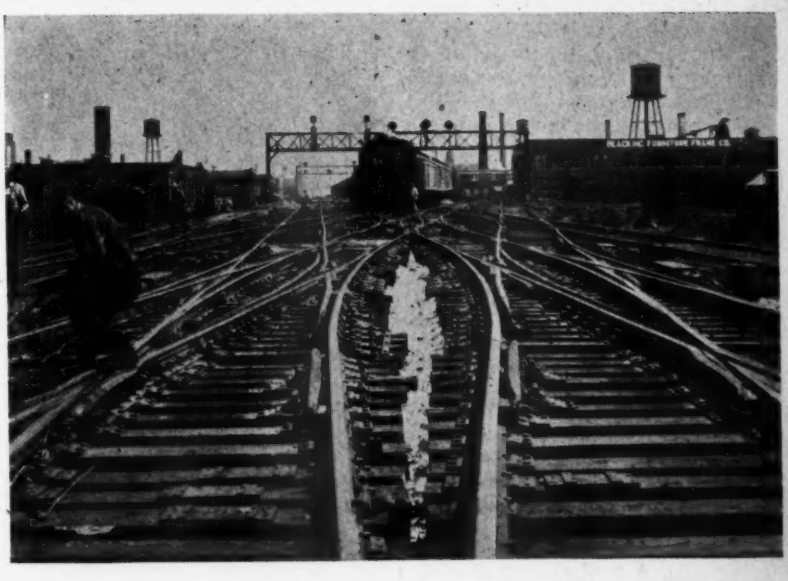
Completed on Schedule

The work was started on schedule on August 4 and was completed on schedule on August 28. One day was lost unavoidably by reasons having no relation to the project, but this was later made up by the installation of two adjacent units on the same day. The assembly, installation and initial surfacing of the 27 units required 36,413 man-hours of work with no accidents other than one reportedly sprained back.

The final surfacing is still in progress, and it is planned to install rail and flange lubricators on the tracks approaching the crossing in order to reduce wear on the curved portions of the double-slip switches and turnouts.

Personnel

The plans for the special trackwork were prepared by the author and A. F. Huber, chief engineer, Ramapo Ajax Division, American Brake Shoe Company, under the supervision of C. T. Jackson, assistant chief engineer of the Milwaukee, and E. C. Vandenburgh, then engineer of maintenance of the North Western, and now chief



Right Above—Use of a Buda Power Drill Speeded Rail Drilling for Connections With Old Rails. Right—A Part of the Western Avenue Crossing, Showing Two of the New Double-Slip Switches in the Foreground

engineer. The units were fabricated by the Ramapo Ajax Division in accordance with final detail drawings prepared by its engineering department.

The plans for installing the units were prepared by G. A. Saint, assistant engineer of the North Western, who followed this phase throughout the progress of the work. The installation work was supervised by T. H. Strate, division engineer, and D. H. Herlihy, roadmaster, both of Milwaukee, and P. V. Thelander, division engineer, and J. E. Wilkinson, roadmaster, both of the North Western. The signal and interlocking work was supervised by M. H. Schmidt, supervisor telegraph and signals of the Milwaukee. The work was carried out under generally favorable weather conditions. No difficulty was experienced with misfit material and no unforeseen difficulties interfered with the orderly procedure as planned.

1945 Rail Output Shows Slight Drop

ALTHOUGH slightly lower than the high figure set in 1944, the production of rails in the United States was relatively high in 1945, with a total of 2,417,520 net tons representing a drop of 73,136 tons, or 2.9 per cent, compared with 1944, according to figures published in the annual statistical report of the American Iron and Steel Institute for 1945. This marks the first break in the six-year succession in which rail production has registered a gain over the preceding year, and, while it was substantially higher than the annual production in any of the 14 years preceding 1944, it compares very unfavorably with the production of rails in the years 1929 and 1927, when 3,048,795 and 3,143,264 net tons, respectively, were produced.

The production of rail in 1945 and in previous years back to 1927 is shown in the accompanying table, in which the output for each year is broken down into four weight groups. It will be noted from a study of this table that production in all weight groups in 1945, with the exception of the heaviest, fell off from the preceding year, and that the greatest output continued to remain in the two heaviest weight groups, amounting to 79.2 per cent of the total. Specifically, tonnage in the heaviest weight group, which includes rail sections of 120 lb. or more, increased from 894,245 tons in 1944 to 930,987 tons in 1945, or 4.1 per cent. In the group weighing 100 lb. and less than 120 lb., the drop in production was from 1,032,256 tons in 1944 to 985,310 tons in 1945, or 4.6 per cent; in the group weighing more than 60 lb. and less than 100 lb., the decrease was from 401,213 tons in 1944 to 350,499 tons in 1945, or 12.6 per cent; and in the group weighing 60 lb. or less production fell off from 162,942 tons to 150,724 tons, or 7.5 per cent.

Of the total tonnage of rails produced in 1945, 2,350,686 tons, or 97.2 per cent, were rolled from open-hearth steel. This percentage is exactly the same as for the preceding year. Only 5,835 tons of rails were rolled from Bessemer and electric steels in 1945, a drop of 59.1 per cent compared with the 14,261 tons rolled in 1944, making this the second successive year in which tonnage in this category has shown a decrease from the preceding year, in contrast with the tendency to increase that prevailed prior to 1944. Also included in the total output for 1945 were 54,494 tons rolled from old rails and 22,804 tons of new rail, rolled in girder and high tee sections.

As with the production of rails, the output of fastenings in 1945 likewise showed a small reduction, dropping from 807,066 tons in 1944 to 784,843 tons in 1945, a decrease of 2.7 per cent. The total output of fastenings in 1945 included 179,458 tons of joint or splice bars, 49,236 tons of other rail joints, and a total of 556,149 tons of tie plates.

Production of Rails by Weight Per Yard—Net Tons

Years	60 lb. or less	Over 60 and less than 100 lb.	100 and less than 120 lb.	120 lb. and over	Total
1927	*181,256	†798,226	1,472,155	691,627	3,143,264
1928	*150,301	†662,053	1,348,199	804,639	2,965,192
1929	*158,326	†574,080	1,381,631	934,758	3,048,795
1930	*107,101	†391,079	935,756	664,085	2,098,021
1931	* 56,100	†166,793	555,242	518,546	1,296,681
1932	* 18,654	† 47,374	240,902	143,944	450,874
1933	55,010	63,153	172,488	175,601	466,252
1934	78,495	101,640	550,639	400,677	1,131,451
1935	63,982	112,431	381,696	238,812	796,921
1936	107,644	135,585	684,910	438,089	1,366,228
1937	113,889	218,374	815,280	471,685	1,619,228
1938	50,375	85,177	371,534	190,556	697,642
1939	92,994	83,611	620,992	515,050	1,312,647
1940	140,443	339,672	688,109	510,762	1,678,986
1941	172,264	323,968	820,695	610,924	1,927,851
1942	124,938	438,562	924,851	607,808	2,096,159
1943	164,096	364,715	847,839	750,346	2,126,996
1944	162,942	401,213	1,032,256	894,245	2,490,656
1945	150,724	350,499	985,310	930,987	2,417,520

*Under 50 lb. per yd.
†50 and less than 100 lb. per yd.

Flame Cleaning Deck Members of a Steel Bridge by the Oxweld Method. After Application of Flame the Surfaces Are Wire-Brushed and Painted While Warm.

Chicago Meeting Finds B. & B. Group "Going Strong"

Large attendance, a spirit of interest and enthusiasm, an outstanding program, and various special features, including an unusually large exhibit, characterize the first full-scale convention in three years

"FULL steam ahead" is a term that aptly describes the vigor manifested by the American Railway Bridge and Building Association at its three-day annual convention held at the Hotel Stevens, Chicago, on September 17-19. This observation is in order because of the gratifying attendance at the meeting, the spirit of interest and enthusiasm manifested by those present, and the broad and constructive nature of the program, which included technical reports and addresses on subjects comprising a representative cross section of the many problems confronting bridge, building and water service men.

The success of this meeting is particularly significant in view of the fact that it was the first full-scale three-day convention held by the association since 1942, the meetings in the meantime having been restricted by war-time conditions to one-day sessions. Further enhancing the contrast of this year's meeting with those of the last few years were a number of supplemental features, including a large exhibit of bridge, building and water service equipment and materials, and a well-attended inspection trip to a recently completed Diesel maintenance and repair shop near Chicago.

Concurrent With Roadmasters

Establishing this year's meeting as one of the most unusual in the long history of the association was the fact that it was held concurrently with the annual convention of the Roadmasters' and Maintenance of Way Association, the activities of which were reported in detail in the October issue. As indicated in that report, the two associations held their regular sessions in separate rooms in the Stevens hotel, but came together in a joint opening session and subsequently on several occasions to hear addresses on subjects of mutual interest.

The fact that the two conventions were held concurrently had the advantage of making it possible for members and guests of each association to attend sessions of the other of particular interest, and also for higher engineering and maintenance officers, many of whom were in attendance, to be present at both conventions at the same time. Another advantage of the concurrent meetings, as pointed out in the October issue, was the fact that they made possible a joint exhibit of manufacturer's products by the Bridge and Building Supply Men's Association and the Track Supply Association, which, in number of exhibitors and scope, exceeded any previous exhibit held by either of the associations. A complete list of the exhibitors, together with the names of their representatives present and the products on display, was published in the October issue.

To avail themselves of the unique opportunities afforded by the concurrent sessions and the exhibit, a total of 693 members and guests

Bridge and Building Section

Neal D. Howard
President
Bridge and Building Association

registered at the two meetings. The attendance was augmented by the fact that a number of technical committees of the American Railway Engineering Association held meetings in Chicago during the convention week in order that their members might see the exhibit and attend specific sessions of the convention. Notwithstanding the large attendance, there is no doubt but that it would have been considerably larger if there had not been a dearth of hotel accommodations, the Stevens hotel alone having rejected more than 200 requests for rooms.

F. G. Campbell
First Vice-President

J. S. Hancock
Second Vice-President

E. H. Barnhart
Third Vice-President

W. F. Martens
Fourth Vice-President

C. R. Knowles
Treasurer

The combined opening session of the conventions, as well as the other joint sessions held later, was presided over jointly by Neal D. Howard, editor, *Railway Engineering and Maintenance*, and president of the Bridge and Building Association, and Herman E. Kirby, assistant engineer, Chesapeake & Ohio, and president of the Roadmasters' Association. All separate sessions of the Bridge and Building group were presided over by Mr. Howard, assisted by Frank G. Campbell, assistant chief engineer, Elgin, Joliet & Eastern, and first vice-president of the association, and J. S. Hancock, bridge engineer, Detroit, Toledo & Ironton, and second vice-president.

As pointed out in the October issue, those present at the various joint sessions of the two conventions heard words of greeting from J. B. Akers, chief engineer, Southern, and president of the A.R.E.A.; George B. Coffey, president of the Bridge and Building Supply Men's Association; and Lewis Thomas, secretary of the Track Supply Association, and director of exhibits for the two supply groups. They also heard a challenging opening address by E. M. Hastings, chief engineer, Richmond, Fredericksburg & Potomac, and other addresses by Major-General Carl R. Gray, Jr., vice-president, Chicago & North Western; Donald D. Conn, executive vice-president, Transportation Association of America; W. K. Wallace, chief civil engineer, London, Midland & Scottish; and L. G. Bentley, general safety agent, Chesapeake & Ohio. General Gray spoke on The "Boys" of Company A; Mr. Conn on Problems Ahead in Railway Transportation; Mr. Wallace on Reconversion and Recovery Problems on the British Railways; and Mr. Bentley on How the Chesapeake & Ohio Won the Harriman Gold Medal Award in 1945. Abstracts of all these addresses were presented in the October issue.

Bridge and Building Association

Officers 1945-46

Neal D. Howard, president, editor, *Railway Engineering and Maintenance*, Chicago.

F. G. Campbell, first vice-president, asst. ch. engr., E.J.&E., Joliet, Ill.

J. S. Hancock, second vice-president, br. engr., D.T.&I., Dearborn, Mich.

E. H. Barnhart, third vice-president, div. engr., B.&O., Garrett, Ind.

W. F. Martens, fourth vice-president, gen. fore. b.b.&w.s., A.T.&S.F., San Bernardino, Cal.

Elise LaChance, secretary, Chicago.

C. R. Knowles, treasurer, supt. w.s., I.C. (retired), Chicago.

Directors

A. B. Chapman, engr. and supt., b.&b., C.M.St.P.&P., Chicago.

W. A. Huckstep, gen. bldg., supv., M.P., St. Louis, Mo.

F. R. Spofford, asst. div. engr., B.&M., Dover, N. H.

Guy E. Martin, supt. w.s., I.C., Chicago.

B. R. Myers, asst. to ch. engr., C&N.W., Chicago.

L. E. Peyser, prin. asst. arch., S.P., San Francisco, Cal.

J. L. Varker, ex officio, supv. b. & b., D.&H., Carbondale, Pa.

At the separate sessions of the Bridge and Building group, which were reserved exclusively for a discussion of current problems facing the bridge, building and water service forces of the railways, the program consisted principally of the presentation and consideration of eight technical committe reports and three addresses. The latter were presented by M. C. Hope, senior assistant sanitary engineer, in temporary charge of the Land and Air Carrier Section of the Sanitary Engineering division of the United States Public Health Service, who spoke on Federal Interest and Responsibility in Railway Sanitation; by J. C. Sherrick, partner, Holabird & Root, architects, Chicago, who spoke on Modern Architecture and Materials in Railway Building Construction and Maintenance; and H. I. Benjamin, vice-chairman, System Committee on Insurance, Southern Pacific, who spoke on Preventing Bridge, Building and Tunnel Fires.

The following subjects were covered by the eight technical committee reports: Adapting Turntables to Meet Modern Conditions; Methods of Cleaning Water Lines, Sewers and Drains; Developments in the Use of Off-Track Work Equipment; Methods of Improving the Strength, Durability and Wear Resistance of Concrete; Tools and Equipment For Bridge and Building Shops; Cause and Prevention of Personal Injuries to Bridge and Building Employees; Utility and Economy of Pre-Fabricated Buildings; and Servicing Facilities for Diesel Locomotives.

Published in full in the following pages are all the committee reports. Abstracts of the addresses by Mr. Hope and Mr. Sherrick are also included. Mr. Benjamin's address will be published in a later issue.

Special Events

The tempo of the convention was enhanced by a number of special events. One of these included the election of Charles A. Buford, executive vice-president, Chicago, Milwaukee, St. Paul & Pacific as an

honorary member, and the presentation of honorary membership certificate to the three honorary members elected at last year's meeting, these being Ralph Budd, president, Burlington Lines; Charles E. Johnston, chairman, Western Association of Railway Executives; and Fred L. Thompson, chief engineer (retired), Illinois Central. The presentation of the honorary membership certificates was made by Armstrong Chinn, chief executive officer of the Alton, and a past-president of the Association.

Another special event was a banquet tendered to members of the two associations and their families, by the Track Supply Association and the Bridge and Building Supply Men's Association, at which the attendance was 857 persons. A third such event was the inspection trip, made after the close of the convention, to the new Diesel shop of the Burlington at Clyde (Chicago), Ill., where a group including 50 members and guests was greeted by Edward Flynn, executive vice-president of the Burlington, and conducted through the facilities by representatives of the engineering and mechanical departments.

New Officers

In the election of officers for the ensuing year, Mr. Campbell was advanced from first vice-president to president; Mr. Hancock was advanced from second vice-president to first vice-president; E. H. Barnhart, division engineer, Baltimore & Ohio, Garrett, Ind., was advanced from third vice-president to second vice-president; W. F. Martens, general foreman, bridges, buildings and water service, Atchison, Topeka & Santa Fe, San Bernardino, Cal., was advanced from fourth vice-president to third vice-president; W. A. Huckstep, general building supervisor, Missouri Pacific, St. Louis, Mo., and a director, was elected fourth vice-president, and C. R. Knowles, superintendent water service (retired), Illinois Central, and Elise LaChance were re-elected treasurer and secretary, respectively. The new directors elected were: H. M. Harlow, assistant general supervisor bridges and buildings, Chesapeake & Ohio, Richmond, Va.; H. B. Christianson, assistant to chief engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago; and F. R. Spofford, assistant division engineer, Boston & Maine, Dover, N. H., (re-elected).

Eight subjects were selected for investigation during the year, as follows: Utilization of New Types of Materials in Buildings; Use of Laminated Members in Bridges; Unfilled Needs in Power Machines and Power Tools for Bridge and Building Work; Development and Training of Supervisory Personnel in Bridge, Building and Water Service Forces; Construction and Maintenance of Shop and Enginehouse Floors and Runways; Economies To Be Derived Through the Modernization of Obsolete Water Stations; Safety Measures to Protect Employees Within Buildings Against Fire and Accident; and Need for Inspection of Substructures and Under-Water Foundations.

Enthusiastic over the success of its 1946 annual convention, and reflecting the feeling of those in attendance, the Executive committee of the association, meeting after the closing session, voted to hold its 1947 convention during the week of September 15, concurrent again with the annual meeting of the Roadmasters' Association.

President's Address

Speaking at the opening session of the Bridge and Building group, President Howard called for the loyal, understanding support of all bridge and building men in the solution of the problems facing railway management, and, in turn, the support of railway management for the constructive efforts of the association. After reviewing briefly the problems facing the railway industry he said in part as follows:

"In all these things, the railroads need the wisdom and support of our association and of its individual members. To others on the railways falls the major responsibility in the solution of many of these problems, but we, individually and as an association, cannot slight our share. We must back our industry in its fight against unfair competition, inequitable regulation of and subsidies to other forms of transportation; we must help our industry build back to new and higher standards of comfort and safety; we must help meet the challenge of rising costs with new technological developments that will prolong the life of our structures, minimize interference with traffic, and increase the efficiency and economy with which every item of our routine work is carried out; and we must accept the responsibility of strengthening supervisory personnel within at least our own department, so that when our work is done, we can lay down our tools with the confidence that our work will go on in capable hands."

After expressing a high degree of satisfaction with the achievements of the association over the years in the interest of the railways, President Howard continued, in part:

B. & B. SECTION

"But I am not satisfied that most railway managements, or the railways as a whole, have given our association the support to which it is entitled . . . the result of this situation over the years has limited severely the effectiveness of our group—the scope of its work, the breadth and soundness of its studies and recommendations, and the range of its influence for good among the thousands of bridge, building and water service supervisory officers over the country—all of which is contrary to the best interests of the railroads."

Problems of Sanitation

IN HIS address on Federal Interest and Responsibility in Railway Sanitation, Mr. Hope first traced in a comprehensive manner the development of sanitation regulations in the United States, particularly as they apply to the railroads. These regulations, he said, cover all sanitation aspects involved in producing acceptable drinking water, including a determination of the quality of the raw water, the effectiveness of the treatment, bacteriological control, and the elimination of sanitary hazards in the plant and distribution system, such as cross connections, blow-offs to sewers, and plumbing defects. Mr. Hope also discussed the functions of the Public Health Service, the scope of its activities, and the nature of the sanitation standards now in force.

A considerable portion of Mr. Hope's address was devoted to a discussion of the provisions of the Sanitation Manual for Land and Air Conveyances Operating in Interstate Traffic insofar as they apply to railroads. The present manual, which was adopted in 1942, is designed to provide public health agencies and carriers with the necessary information for control of water supplies, excreta disposal, garbage and refuse disposal, the handling of milk and milk products, the design of eating and drinking establishments, and other aspects of public sanitation. Mr. Hope is of the opinion that the greatest aspect of this problem is that of providing suitable watering facilities, stating that "frankly, present practices in this regard are unsatisfactory." He went on to discuss what are considered some of the undesirable practices in this respect, and recommended ways for bettering

them. The "perennial" question of excreta disposal at terminals and yards also came in for discussion, in the course of which Mr. Hope referred to the investigation in this regard that is now under way, the cost of which ($200,000) is being borne by the Association of American Railroads.

Railway Architecture

POINTING to the new streamliner equipment that the railroads now possess, Mr. Sherrick, in his address on Modern Architecture and Materials in Railway Building Construction and Maintenance, asked "What about railroad stations?" Stating that present stations belong, for the most part, in a past era when travelers were compelled to use the railroads for transportation and expected to endure some inconveniences and discomforts, he said that, because the present era offers several forms of transportation, railroad stations must be made more inviting to the traveler.

Good architectural design, Mr. Sherrick said, should first of all assure easy circulation of the patrons from the street to the train, employing well-placed signs, politely and appropriately worded, to mark the route. Also, he said, the design should make the process of ticket buying more pleasant by replacing wall-type ticket windows with open counters and, perhaps, relieving the traveler of his hand bag at that point, delivering it to him at the train by means of a modern conveyor system. Furthermore, he said, the facilities for waiting must be planned to make the chairs comfortable, the lighting adequate for reading, and the surroundings interesting.

A Waiting Room with Open Counters for Ticket Scales, and Other Modern Features

While the basic structural materials, including concrete, steel, brick, stone and wood, will be used for many years to come, Mr. Sherrick said, it is in the equipment and accessories that great improvements have been made and will continue to be made. Although large stations are difficult to air condition, he said new high-velocity systems are being developed which give promise of being applicable to such structures. Panel heating, which he said is not a new system, should be given more consideration.

Tools and Equipment for B. & B. Shops

Report of Committee

THE use of modern tools and equipment by the bridge and building forces is being given much consideration by all railroads, but it must be given even more if they are to keep a jump ahead of rival forms of transportation. We in the B. & B. department should be furnished more modern tools to enable us to secure the skilled labor and economy of operations that we should have in this great industry of ours.

The establishing of large bridge and building department shops at various points along our lines must be determined, of course, by the number and character of structures and other facilities to be maintained. On some roads, one large shop, centrally located, may be desirable, but on most roads a shop should be established on each division. In addition, the larger divisions should also be equipped with portable B. & B. shop outfits in cars.

Where large permanent shops are to be established, it is desirable that all tools and equipment be in one fireproof building, which should be located near the storehouse to facilitate the handling of materials for all classes of work. A stake-body truck should be a part of the equipment of the shop to enable the quick delivery of materials to outlying points. Portable shops should consist of a tool car, preferably a baggage car, equipped with power tools.

H. E. Davis
Chairman

Electricity should be available for all shops, with sufficient outlets to handle all power tools. For each portable outfit an adequate generating plant should be provided. Likewise, compressed air should be available at all permanent shops, secured from stationary compressors, with plenty of outlets, and portable compressors should be furnished for portable shops, where necessary.

Layout

The layout of a division shop should be large enough to accommodate all of the crafts involved, with ample space to operate each piece of machinery without interfering at any time with any other piece of machinery. ("Safety first" being paramount.) To accommodate carpenters, pipefitters, sheetmetal workers, machinists, and a small paint shop force, the building should have from 4,000 to 6,000 sq. ft. of space, with the quarters of the various crafts segregated, and with a foreman's office near the center of the shop. The various machines and work benches, should be located near the walls, with sufficient windows for good daylighting and air circulation.

On some railroads the bridge and building forces handle motor car and roadway equipment repairs. Where this is done, the equipment repair shop should be separate from the main B. & B. shop, with

space of sufficient size to house all of the equipment that comes in. One end of the shop should be used for light repairs, and the other end for heavy repairs; both ends being served by a mono-rail system, or, the equivalent, with a power hoist.

Bridge and building road gangs should have one car equipped with work benches and portable power tools, and this car should contain a generator for furnishing electricity, as these outfits are located many times where electricity is not available.

Tools and Equipment

All large division shops should be equipped as follows: Tilting double-arbor table saw, with 16-in. saws; rip saws, 16-in. to 18-in. blades; band saw; mortising machine with drill-bit attachment; 24-in. planer; jointer, with rabbeting attachments; portable electric saws; electric drills; electric grinders; endless belt sanders; and many other devices such as clamps and vises.

Water works mechanics should be furnished with: Pipe and bolt-threading machine; portable pipe-threading machine; drill press; power sewer rod and pipe cleaners; welding and cutting equipment; and a complete set of sheetmetal worker's tools.

To handle roadway equipment repairs economically, a large assortment of tools should be provided, including: Cylinder grinders; valve tools; lathes; drill presses; all types of gages and micrometers; and an electric hoist and mono-rail system.

The small paint shop should be equipped with: Portable compressors and paint spraying equipment; caulking guns; grinders, and hand tools.

All machines should be of the individual, motor-operated type, and so located that they do not interfere with the operation of any adjacent machines. There should be two portable work benches, to save carrying parts back and forth from the permanent bench; thus effecting a large saving in time and money.

The storehouse should keep a close inventory of parts and materials, and be kept well stocked at all times, as a machine down for two or three weeks, waiting on parts, is not paying dividends.

The division shop should be able to work material up to 6 to 8 in., and pipe up to and including 12 in. If the car department does not have a large rip saw, or if it is not conveniently located, the bridge and building shop should have one to enable the salvaging of second-hand bridge stringers. Old bridge stringers are generally deteriorated at the ends only, and by cutting 18 in. off each end, 8 to 10 ft. can usually be saved for ripping; the salvage being used for sleepers, sheathing, etc. If used in dry places, this material will last for years, effecting a considerable saving. Furthermore, scarce as new lumber has been in recent years, it would appear that the real shortage has only just started.

Types of Work

Properly equipped bridge and building shops will handle valve repairs; repairs to, and the construction of, window sash and frames, doors and frames, screens, signs and crossing gates; the construction of small buildings, such as telephone booths, toilets, switch shanties, flag shanties and tool houses; and the cutting of the framework of larger buildings for field erection, thereby facilitating and expediting their construction. Also, repairs to damaged freight shipments, as are now done by some railroads, could be made in these shops, with large savings.

Stove and furnace repairs, as handled by sheetmetal workers, including the manufacture of stovepipe and elbows, could be done much more cheaply in a company B. & B. shop, with an appreciable improvement in quality over purchased items, and, likewise, gutter and conductor pipe, as well as many other items, could be fabricated at a saving, and, of great importance, as needed.

Large Division Bridge and Building Shops Should Be Equipped With a Variety of Power-Driven Tools

The past five years have taught us much about the economy possible in manufacturing our own millwork. Since the majority of our older buildings do not have set standards for window and door sizes, it has been practically impossible to obtain anything from supply houses, and where the needed items were obtainable, the cost has been prohibitive. As the result of this experience, it is evident that more can be accomplished, and a sizeable saving effected, by doing much of this work with our own forces.

B. & B. shops equipped with modern machinery and tools, and manned by trained personnel, can compete with any production shop in outside industry, both as to the quantity and quality of the work done. The frequent break-down of facilities on the railroads is constantly a matter of importance and concern, and these can be shortened considerably when proper tools and equipment are available to carry out the necessary repair work.

Time has proved that those shops with modern equipment get the better grade of workmen; workmen that are proud of the quality of work they turn out. The saying of our grandfathers, "A workman is known by his tools," is just as true today as it was in their time. The psychological effect produced by the condition and fitness of the tools and equipment with which a man works is the greatest factor in determining the quality and quantity of the work that can be expected of him.

B. & B. SECTION

Committee Personnel

H. E. Davis (chairman), supvr., b. & b., N. Y. C., Chicago; P. B. Collier (vice-chairman), b. & b. supvr., M. P., St. Louis, Mo.; P. F. McNally, Sr. (vice-chairman), asst. b. & b. supvr., S. P., Ogden, Utah; H. E. Skinner (vice-chairman), br. insp., E. J. & E., Joliet, Ill.; F. G. Campbell, asst. ch. engr., E. J. & E., Joliet, Ill.; G. S. Crites, div. engr., B. & O., Baltimore, Md.; A. B. Hillman, engr. m. of w., C. & W. I.-Belt, Chicago; E. R. Johnson, salesman, Harron, Rickard & McCone, Los Angeles, Cal.; A. A. McDermott, b. & b. supvr., S. P., Dunsmuir, Cal.; J. M. Salmon, Jr., asst. br. insp., L. & N., Louisville, Ky.; C. J. Shapland, asst. engr. b. & b., C. V., St. Albans, Vt.; William A. Stewart, supvr. br. (retired), C. V., Stafford, Conn.; Liu Tseng-ta, Chinese trainee, C. M. St. P. & P., Union Station, Chicago; J. L. Varker, b. & b. supvr., Delaware & Hudson, Carbondale, Pennsylvania.

Discussion

Guy E. Martin (I.C.) mentioned that cypress and poplar lumber can be salvaged from old stations and other buildings and used by well-equipped shops for repairing damaged furniture shipments and for making office furniture for temporary offices. F. G. Campbell (E.J.&E.) agreed that company forces can turn out good quality work with such shops which will compare favorably with that of commercial shops, but he questioned whether the costs would be less. Answering this question, Chairman Davis said that costs of work done by company forces are often lower, than if it is done by others.

A. E. Bechtelheimer (C.&N.W.) wanted to know whether there were any such completely equipped shops as described in the report, a query which H. Pryor (St. L.-S.F.) answered by saying that his road had

such a shop and also has outfitted four cars as mobile shops. He added that well-equipped fixed and mobile shops are helpful in attracting and holding skilled personnel.

Lee Mayfield (M.P.) touched off a live subject by announcing that, in his experience, a 1½-ton truck for bridge and building work will pay for itself in about a year, and is ideal for transporting men and for emergency use. Wilbur Lampson (Me. Cent.) questioned the advisability of having trucks of such a low tonnage rating, and after further discussion by L. H. White (I.C.), Mr. Campbell, and V. W. Hutchings (S.P.), the general consensus was that a three-ton truck is the most satisfactory.

Answering a question raised by Mr. Campbell, Chairman Davis stated that a mobile shop for bridge gangs should be equipped with a 12-tool air compressor and the necessary tools, a portable electric generator with electric drills and other appliances, and extension cords for connection with utility power lines. He added that box cars do not make good mobile shops and that baggage cars should be used for this purpose. Mr. Pryor expressed the opinion that, in general, pneumatic equipment is most suitable for bridge gangs and electric equipment for building gangs.

Servicing Facilities for Diesel Locomotives

Committee Report

SINCE the first streamlined Diesel passenger train went into regular service in 1934, there has been a steady increase in the use of Diesel locomotives. On February 1, 1946, the records show the following number in service and on order:

	No. in Service	No. on Order	Total
Passenger	213	107	320
Freight	318	110	428
Passenger or freight	89	2	91
Switching	2,373	148	2,521
Total	2,993	367	3,360

The total of 3,360 represents about 8 per cent of all locomotives in the United States; and if investment is considered, the percentage is larger.

Up to the present time the maintenance of Diesel facilities has not been much of a problem because such facilities are still in the development stage and only a few have been in service long enough to require major repairs. Some roads are now making their first installation, and, if correctly designed and installed, will require minimum maintenance. This report will deal mainly with fuel, water, and sanding facilities outside of Diesel shops, as developed by those roads with considerable experience, and will present a few observations and suggestions by the committee.

Other Facilities Required

Diesel locomotives consist of one to four power units, each of which requires individual servicing. Due to the multiplicity of servicing points on each unit, the facilities for steam locomotives are not suitable for servicing Diesel locomotives and other facilities are required.

The number of locomotives to be serviced and the time available for servicing must be given full consideration in determining the type of facilities to be installed. At terminals, high speed in the servicing and quick return of locomotives to service may not be so important, and extensive facilities may not be justified where only a few locomotives are serviced. However, on the road, where time is limited, the servicing facilities provided must be adequate whether one train or several trains are to be serviced; it is usually only necessary to increase the size of storage tanks when additional trains are to be handled. This means that servicing facilities must have sufficient capacity and be maintained in such condition that complete servicing of a locomotive is finished by the time its train is inspected and the station work is done.

B. R. Meyers
Chairman

Regular servicing stations are usually spaced from 400 to 500 miles apart, with provision for emergency servicing at intermediate points where sufficient help will be available on short notice.

Fuel Oil

The oil used as fuel on Diesels has the following characteristics:

Free from grit, acid, fibrous or other foreign matter.

Water and sediment should not exceed 0.05 per cent.

Pour point not higher than minus 10 deg. F.

Gravity 30 to 40 deg. A.P.I.

Viscosity 35 to 45 sec. at 100 deg. F.

Ignition quality should have Cetane rating of not less than 50.

Greater percentage will distill under 650 deg. F.

Flash point above 150 deg. F.

It is important to have adequate storage facilities, and tanks should hold minimum requirements and have capacity to unload a full tank car. Some roads require storage capacity sufficient for a week's supply to guard against interruptions in delivery. Storage tanks should be as close to service outlets as possible to minimize pipe friction. It is desirable that they be placed above ground to permit ready inspection and periodic painting. They should have dikes around them with a capacity of 1½ times that of the tanks to confine the oil in case of leakage. Where law requires that storage tanks be under ground, they should be placed in pits large enough to permit proper inspection and maintenance. They should be properly anchored if subject to hydrostatic pressure, and should be grounded to protect them against static electricity. All tanks should be equipped with manholes and with adequate size vents with flame arresters, and should provide for cleaning and flushing. Consideration should be given to the installation of two tanks connected up so that either can be used independently. This permits repairs to be made to one

B. & B. SECTION

without disrupting service. Except on large-capacity high tanks, the intake and discharge pipes should enter at the top to eliminate loss of oil in case of pipe breakage.

Diesel fuel oil flows freely in cold weather and heating is unnecessary. Booster pumps are used in most cases to insure adequate flow; and since a large gravity head is not required, the storage tanks are usually placed on low cradles just above the ground level. Where multiple power units are serviced, there should be an outlet for each unit, with the various outlets so spaced that all units can be serviced at one time or without respotting the locomotive. This is more satisfactory than having one outlet and using a long length of hose. To keep the length of hose to a minimum, some installations in terminals have riser pipes adjacent to the track, extending to a height of about 9 ft., with swing connection for the hose. However, on the road, it is the usual practice to have each outlet in a pit of sufficient size to accommodate 20 to 25 ft. of hose. These hose pits are usually made of concrete, properly drained and equipped with quick-opening covers, flush with the ground. A long, narrow box permits the hose to be laid out straight, and the use of a lighter weight cover, which can be in sections. False slot bottoms in the pits will keep the hose away from water and dampness and thus prolong their service life.

Fuel oil lines on the road are usually 3-in., and the hose used with them is 2½ in., equipped with connections for coupling direct to locomotives. Pipe of larger size may be required where long lines cause large friction head losses or where a very high rate of delivery is required. Plug-type valves, the same size as the hose, are used with an expansion-ring type coupling with a pin lug. Shank-type couplings may be used but this type sets up more friction. Some roads prefer trigger nozzles. The hose should be wire reinforced and grounded. One road reports that it has cut down maintenance by eliminating the use of flexible hose, and the use instead of 2-in. pipe with flexible mechanical couplers similar to a pantograph.

Pumps should be electrically driven and should have a capacity of 300 gal. per min. or more at road points; they may have a smaller capacity at terminals, depending upon the time element and the number of units to be serviced. Modern pumps have built-in by-passes to absorb surges caused by quick-acting valves. A home-made by-pass can be made easily by using a pressure-relief valve with a pipe connection back to the supply line. At important road servicing points, it is desirable to have dual pump installations for protection.

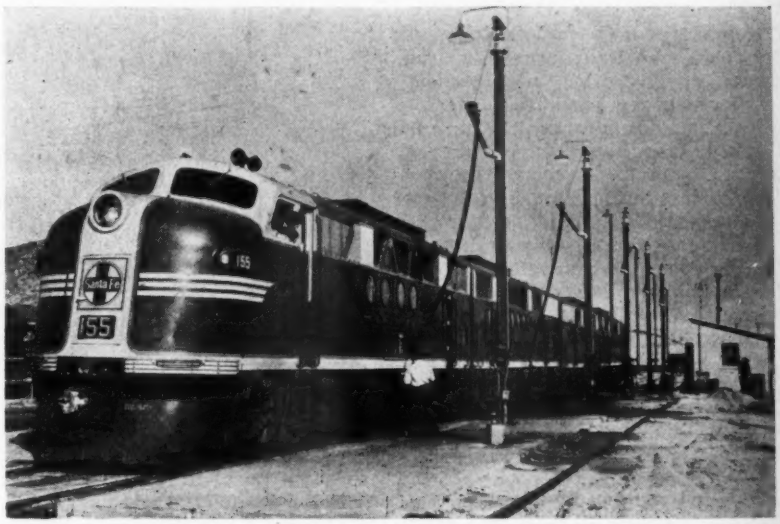
In lieu of a booster pump, installations for switchers have been made by introducing air pressure into storage tanks by means of a small motor-driven compressor.

The road Diesel unit has a capacity of about 1200 gal. for the 1,500-hp. size, and up to 3500 gal. for the 3,000-hp. size, and can usually be serviced from both sides. Switchers hold about 650 gal., depending upon their size, and are usually serviced at some convenient opening at the rear platform.

A fireproof house should be provided for pumps and valves. Wiring should be of approved type and the motors of the non-explosive or vapor-proof type. Switch controls for pumps should be at delivery points.

Filters should be installed to insure that no foreign matter in the oil is delivered to the locomotive tanks. Extreme care is also needed to guard against dirt getting on hose coupling and thence into the tanks.

Where joint facilities are maintained, it is necessary to have a meter to insure correct billing. A meter or tank gage is desirable in all installations to obtain a record of oil unloaded or dispersed. Many recent installations provide concrete box conduits with removable covers for all pipe lines to provide easy access for inspection and maintenance.



Diesel Fueling Facilities on the Atchison, Topeka & Santa Fe at Barstow, Cal.

Water

Diesel locomotives require less water than steam locomotives, although the requirements as to quality are more exacting. Engine cooling systems hold from 100 to 600 gal., and if all connections are kept tight they will not require filling except at terminals where hydrants can be conveniently located. In case the pressure is very low, a large size hose may be required. Hydrants should be as close to the servicing point as possible to keep the hose to a minimum.

Water satisfactory for steam locomotives is usually not pure enough for use in Diesel cooling systems. It is recognized that distilled water, or its equivalent, must be provided for this use to prevent trouble on the road and to eliminate expensive maintenance to the units. Proper treatment must prepare the water for many temperature changes in the cooling cycle, in order not to damage the various metals and materials with which it comes in contact. Even when distilled or demineralized water is furnished, an inhibitor is usually added to prevent corrosion, as it is very important that no rust or scale deposits be permitted in the cooling system.

Many roads use water which has been treated for steam locomotives, and further treat the water by additives placed in the cooling system. While this method has been more or less satisfactory, it is pointed out that leakage in the cooling system may result in incorrect treatment; and it is felt that a better arrangement is to have a cooling water storage tank at supply points, equipped with necessary treating and testing equipment, so that correct treatment can be insured before water is placed in the cooling system. Some roads have set

up equipment to furnish distilled water for use in cooling systems, which is supplemented with a chromate or other suitable treatment that may be required.

One western road has installed a water evaporating plant consisting of a three-unit evaporator with capacity for producing 20,000 gal. of distilled water per day. Steam from the terminal boiler plant furnishes heat for the plant, and the entire operation is automatic, including the mixing of a soluble oil with the distilled water to make it non-corrosive.

Diesel passenger locomotives are equipped with generators to furnish steam to the train steam line. The water storage capacity for steam generator supply varies from 1,000 to 2,500 gal. The amount of water consumed varies with the number of generators in the locomotive, the number of cars on the train, and the outside temperature. Water used in these generators requires very careful treatment to keep the generator coils free from scale and corrosion. The maximum consumption of water per generator is about 170 gal. per hour for small generators and up to 340 gal. per hour for the large type.

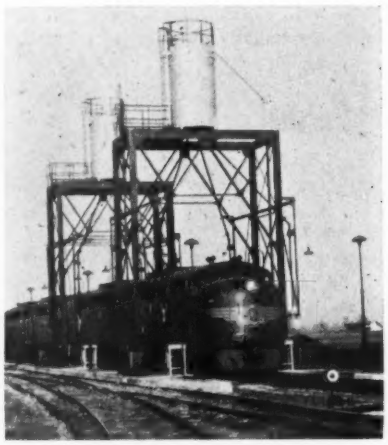
The heating plants of Diesel locomotives should require filling only at points where fuel oil is taken, except in extreme cold weather when it may be necessary to call on intermediate points. These intermediate points should be at scheduled stops and the servicing equipment provided should be of ample capacity to avoid delays. This will usually require 2-in. or 2½-in. hydrants and connecting hose, with pipe lines and pressures sufficient to deliver 300 to 400 gal. per min. If booster pumps are required, they should be automatic in operation or have switch control at the hose outlet. Separate storage tanks for steam generator water supply appears desirable, where the water can be treated with a combination phosphate-tannin or some other suitable treatment before delivery to locomotives.

Servicing outlets for water should be located so that water can be delivered to the cooling and generator storage tanks at the same time locomotives are taking on fuel oil.

Sand

Sand used for steam locomotives has been found satisfactory for Diesel use; however, more extensive facilities are needed to deliver it to the sandboxes of Diesels. Sand should not be put into Diesels with compressed air, as dust should be avoided as much as possible. An overhead storage tank with gravity feed is the recommended practice.

A road Diesel unit has a sandbox at each corner, with service openings on the sides of the locomotive about 8 ft. above the rails. Each sandbox holds from 4 to 10 cu. ft. There are no windows or gages on these sandboxes to indicate the level of the sand; therefore, the valve should be located in the delivery line as close as possible to the discharge end to minimize the spilling of sand. These sandbox



Servicing a Diesel-Electric Locomotive on the Erie at Marion, Ohio

openings do not require special fitting, so any type of nozzle may be used which will enter the openings.

Minimum sanding facilities for road Diesels consist of an overhead storage tank of sufficient capacity for one locomotive, with a delivery spout on each side so the two sandboxes opposite each other can be filled at one time. On a four-unit locomotive, this arrangement requires spotting the locomotive eight times. If hose of sufficient length is used on the ends of the delivery pipes, the end boxes in adjacent units can be filled at one spotting, thus requiring only five spots for a four-unit locomotive.

Several manufacturers of railroad sanding facilities have designed systems which deliver sand to all four boxes on a unit at one time. This requires a higher elevation for the sand storage bin, or a separate bin over each set of spouts. Any number of these units may be set up in a row at the proper spacing to service several units at one spotting. One design on the market consists of an overhead storage bin holding about ten tons of sand, which is hung on a monorail over the center of the servicing track. Suspended from the tank is a delivery spout with a suitable length of hose for each side. The monorail unit is moved by an electric motor controlled by rope pulls along one side of the track. The monorail is long enough so that one locomotive can be serviced without respotting. The storage bin is spotted in a central location when not in use, where a discharge pipe replenishes its supply.

Road Diesels need sand servicing only at the terminals of their runs, and thorough study should be made before extensive facilities are installed to insure that the expense can be justified.

Sand delivery spouts and hose should be a minimum of 3 in. in diameter and should be fitted with moisture-proof valves. To insure proper delivery, the spouts should have a slope of not less than 35 deg. with the horizontal. Wrought iron pipe is used by many roads for sand piping. When turns are necessary, a 45-deg. "Y" is used, with the straight leg capped. This permits the straight leg to be filled with sand and reduces considerably the wearing of the metal in the turn. There is, also, excessive metal wear just beyond the turn, and it is suggested that a flanged pipe about 18 in. long be installed in the line at this point to provide for easy replacement, and to keep the amount of pipe replaced to the actual excessive wear area.

The sand openings of Diesel switchers vary from 4 ft. 4 in. to 12 ft. 6 in. above top of rail and are found on the tops, sides and ends of various type units, requiring the use of flexible hose to service all of the particular types that may be in service at any one terminal. It is unfortunate that the sandbox openings on all Diesels have not been standardized, so they can be filled from the top of the units; and thus considerably simplify the required sanding facilities.

Most towers and storage bins are of steel construction, although some roads have used wood. The present trend is to provide for dry sand storage in new coaling stations; and some roads have designated a track at some coaling plants for Diesel sanding.

In considering a new separate facility for sanding Diesels, thought should be given to the hauling of dry sand from an existing drying plant, and thus eliminate the necessity for constructing additional sand-drying facilities. This would require only a small hopper to receive the sand, which could then be elevated to the storage tank.

Fire Hazard

Diesel locomotives present more of a fire hazard than is generally realized. Oil, dust, paper, etc., are picked up while running and accumulate on trucks, traction motors, fuel tanks, and other parts under the floor, setting up conditions where fires are easily started. Many fires have been

started by sparks from brake shoes. Smoking and the use of open flames should be prohibited around Diesel fueling stations, and every precaution should be taken to prevent oil leakage. A thoroughly satisfactory system of fire-fighting apparatus for road protection has not, as yet, been adopted, but many roads have provided facilities for this purpose. A water hose with fog nozzle can easily be provided at road servicing points.

Diesel locomotive servicing facilities are very important and must be inspected regularly. We must see that they are in good condition at all times to do our part in keeping today's high-speed trains on schedule.

Committee Personnel

B. R. Meyers (chairman), asst. to ch. engr., C.&N.W., Chicago; L. P. Kimball (vice-chairman), engr. bldgs., B.&O., Baltimore, Md.; A. D. Reed (vice-chairman), mast. carp., C.B.&Q., McCook, Neb.; R. C. Baker, supvr. b.&b., C. &E.I., Danville, Ill.; E. H. Barnhart, div. engr., B.&O., Garrett, Ind.; G. W. Benson, supvr. b.&b., C. of Ga., Macon, Ga.; Elmore J. DeWitt, engr. b.&b., N.Y.O.&W., Middletown, N.Y.; H. M. Dick, mast. carp., Penna., Columbus, Ohio; V. E. Engman, ch. carp., C.M.St..P.&P., Savanna, Ill.; A. C. Johnson, asst. supt. b.&b., E.J.&E., Joliet, Ill.; G. E. Martin, supt. w. s., I.C., Chicago; F. H. Masters, ch. engr., E.J.&E., Joliet, Ill.; L. R. Morgan, fire prevention engr., N.Y.C., Detroit, Mich.; and J. S. Vreeland, sales representative, Simmons-Boardman Publishing Corporation, with headquarters at New York.

Discussion

After a member had inquired about fire-protection appliances on Diesel locomotives, L. R. Morgan (N.Y.C.) stated that, so far, no definite steps had been taken by the Association of American Railroads for fire protection on these locomotives, although several committee meetings have been held and suggestions noted. He added that the limited space available on these locomotives precludes the possibility of using any bulky equipment. One of the suggestions advanced by an A.A.R. committee, he said, is to have two 50-lb. carbon dioxide extinguishers and 50 ft. of hose on each unit, supplemented by a small container of carbon tetrachloride, but he cautioned that the latter extinguisher causes a toxic gas and must be used with extreme care, and by operators who have been instructed in its use.

B. & B. SECTION

Methods of Cleaning Water Lines, Sewers and Drains

Committee Report

WATER main and sewer cleaning has been done to some extent by the railroads for many years using various methods and with varying results. The need for such work has been accentuated in the past few years. Prior to the war, the necessity for effecting economies in operation prompted investigations which revealed that at many points high operating costs were the result of pumping water against high pressures created by obstructed pipe lines. Also during that time many railroads inaugurated high-speed passenger and freight runs which involved schedules that required taking water with minimum delay. This, in many cases, suggested the cleaning of crane lines to permit maximum flow.

During the war, with greatly increased traffic, water requirements for locomotives and other purposes severely taxed the capacity of many plants. The scarcity of labor and materials made it mandatory in most cases to continue operation with existing facilities. This condition, among other things, necessitated obtaining increased capacity from existing pipe lines, and in many instances this was done by cleaning them.

In recent years improved methods of cleaning both water and sewer lines have been developed and several companies are now engaged in this type of work. The assignment of this committee was to review the various methods and this report indicates the result of our findings. It is divided in two parts; the first covering water lines, and the second sewers and drains.

W. D. Gibson
Chairman

Causes for Cleaning

The need for cleaning pipe lines is generally obvious. All water service men are familiar with formulae from which the operating pressure which should prevail under any given pumping condition can be determined readily. If this pressure is exceeded to any great extent, it is apparent that there is an obstruction in the line.

A large percentage of the obstructions found are due to after-precipitation of lime and other mineral salts carried over from lime-soda treating plants, or as a result of reaction in pipe lines from treatment with soda ash or other re-agents in the absence of adequate settling or storage capacity to permit the reaction to be completed before the pipe line is reached. The hardness of these precipitates varies greatly with the mineral content of the water used, and is likely to be very hard.

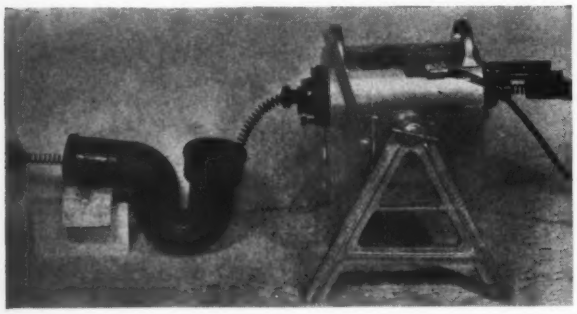
Other causes of obstruction in pipe lines are silting where a muddy supply is used, tuberculation and a deposit of the iron bacteria Crenothrix, which is present in many well waters, particularly in the Missouri River valley.

Reports of recent cleaning operations show that many other obstructions, including large chunks of lead, pump valves and springs, pieces of wood, shovels, partially closed and hidden valves, are found. Hot water filling systems in enginehouses are particularly susceptible to rapid incrustation due to the precipitation of lime and other minerals in the presence of heat.

Methods of Cleaning

In general, the methods of cleaning in use are classed as hydraulic, mechanical and chemical. The hydraulic

method involves the use of a tool consisting of a series of flexible cups attached to a hollow stem, to which are also attached a group of cutting plows that are held firmly against the incrusted material by powerful springs. Water pressure from the rear against the cups propels the tool and the flow of water through the hollow stem, with a nozzle effect at the end, washes the dislodged material ahead and out an opening in the pipe. This tool has been developed to operate in all sizes of pipe, from 4 in. to 60 in., and will execute 90-deg. bends.



Mechanical Pipe-Cleaning Machine in Which the Flexible Shaft Carrying the Rotating Tool Is Driven by an Electric Motor

Mechanical cleaning uses a tool with various types of cutting edges or plows, which is pulled through the pipe by a cable operated by winch, or it is propelled forward by a flexible shaft driven by a gasoline engine or electric motor.

In both hydraulic and mechanical cleaning, the tools are inserted in the line through openings which are prepared by cutting out a section of the pipe and inserting Dresser-type couplings to permit re-use of the section removed and rapid re-assembly of the line. Occasionally, both the hydraulic and mechanical methods are used to clean riser pipes into tanks, pumps or water cranes.

Chemical cleaning is done by circulating acid, usually muriatic, inhibited or otherwise, through the lines to be cleaned, the purpose being to dissolve the incrustation by reaction of the acid with the mineral salts present. The acid is usually pumped from a receptacle to one end of the line, thence through the pipe line and returned to the receptacle where its strength can be checked to determine when the reaction has been completed, and additional acid added as required.

Some examples of the effective cleaning of water lines reported are given in the following:

At an important engine terminal where the daily consumption of water was about equal to what could be pumped in 24 hr. continuous operation, 4,500 lin. ft. of 12-in. water main leading from the treating plant to the various service tanks was cleaned hydraulically. The line was out of service for about 1½ hr. while each of the two cuts were being made to permit entrance and exit of the tool, which traversed the full 4,500 ft. in 21 min. Several tons of mud and scale, and a shovel, were taken from the line. The delivery capacity of the pumps in the treating plant, by reduction in operating head, was increased by 300,000 gal. daily, and the electric current consumption for the average delivery of water was reduced by about 400 kw. h. per day at 1¼ cents per kw. hr.

At an intermediate watering point, delivery from a 50,000-gal. elevated storage tank through a short run of 12-in. pipe to a 10-in. water crane had been reduced to the point that 15 to 20 min. were needed to water a locomotive. The line was found to contain about 5 in. of incrustation and was cleaned mechanically. A metal strainer, practically the same diameter as that of the 12-in. pipe, and with all holes nearly plugged solid, was encountered in the pipe. After cleaning, 4 min. and 9 sec. were required to put 10,000 gal. of water into a locomotive tender.

At another terminal frequent complaints had been received about slow equalization of water between the various tanks in the yard and the slow delivery of water to locomotives at the passenger station. Approximately 5,500 ft. of 8-in. line containing 3 in. of incrustation was cleaned by a combination hydraulic and mechanical process. In the operation, a partially closed 8-in. gate valve not of record and buried under a concrete platform was located and dug out. The position of this valve was the primary reason for slow delivery of water to locomotives.

Most railroad drainage systems are laid with salt-glazed tile, although concrete or cast iron pipe and brick are used to some extent.

Much of the necessity for cleaning these sewer and drain lines appears to be the result of the deposit of cinders, earth and other materials washed in from cinder pits, roundhouses and turntable pits, or through open manholes in surface drainage systems.

Also, frequently where highly mineralized water, such as drainage from locomotive or power-plant blow-down systems, enters sewers, the minerals are deposited, usually forming a very hard incrustation in the pipe. Drainage from oil cellars, engine washing platforms or other facilities where waste oil is present, forms deposits which are troublesome. Tree roots and other growth are sometimes found.

Various types of cleaning devices are used in sewer work, including the old reliable plumber's rodding tape often used to open small domestic sewers which have become clogged. Also for small pipe work, a power cutter operating from a flexible shaft and driven by an electric motor is used. This type of instrument can be equipped with cutters which will remove hard deposits, tree roots, etc.

When sewers of 6-in. diameter and larger, and of any considerable length, are involved, the most practicable and sure method of cleaning seems to be the arrangement whereby buckets or scoops are pulled through the line. Starting with one of small diameter and ending with one just slightly smaller than the internal diameter of the sewer, these buckets, attached to a wire cable, are drawn through the line by winches, one located at a forward manhole and the other at the rear for pull-back purposes. The dislodged material is carried to the surface of the rear manhole where it can be disposed of independently of the sewer system. Distances up to several hundred feet are cleaned with one setting of the winches. Where the material encountered is heavy and compacted, a series of pointed bars comprising a slitter is pulled through the sewer ahead of the buckets.

Examples

Among the interesting experiences of sewer cleaning reported is that at one engine terminal where all of the facilities, including a 30-stall enginehouse, turntable, boiler washing plant, and two mechanical cinder-handling plants, were connected by laterals of various sizes to the general disposal drain, which consisted of about 2,500 ft. of 18-in. and 24-in. tile and concrete pipe. When examined, this drain was found to have not more than 8 in. of open space at the top, and in some places only 4 in. was open for flow. Every time it rained, water backed up into the turntable, enginehouse pits and other facilities, resulting in great inconvenience to operations. Much time and effort were expended in attempting to keep this drain open.

It was finally decided to clean the line by the bucket method described, and many cubic yards of accumulated debris, including mud, cinders, sticks, pieces of pipe, and large pieces of lime formation from the boiler-washing plant drain, were removed. The formation was so hard that it was frequently necessary to use a slitter to loosen it. It is reported that this line was cleaned for a fraction of the cost of replacing it, a procedure that would have soon been necessary if it could not have been cleaned.

Summary

It is the conclusion of this committee that the expense of water pipe and sewer cleaning can in most cases be justified by savings in the cost of pumping water, in the time required to water locomotives, and by reducing maintenance expenses around terminals and other points caused by the necessity for repeated opening of sewers and by necessary repairs occasioned by damage resulting from flooded conditions due to clogged sewers.

It is further concluded that the only assurance that a pipe line is thoroughly cleaned and not partially closed by a hidden valve or other obstruction, is to pass a tool or other object through it, as near in size as possible to the internal diameter of the pipe that is being examined.

It is also the opinion of the committee that where smaller lines, with complicated branch lines from feedwater heaters and blow-down, wash-out and filling systems in enginehouses, are involved, the cleaning can be done to better advantage by the acid method.

Discussion

In a brief discussion following the presentation of this report, all of which reflected the value of cleaning fouled pipe lines and sewers, G. W. Benson (C. of Ga.), pointed out that the results achieved are sometimes no less than amazing. In this connection, he said that, following the cleaning of 16,000 lin. ft. of water line at a terminal, the pump performance was so improved that he was asked by one not informed concerning the cleaning work what accounted for the amazing improvement in pump performance that had occurred.

Chairman Gibson commented upon the fact that, because of the difficulty of procuring pipe, the cleaning of the existing lines has become of greater importance today than ever before, as it may often preclude the necessity of laying new lines.

Committee Personnel

W. D. Gibson (chairman), asst. engr., C.B.&Q., Chicago; J. P. Hanley (vice-chairman), w. s. insp., I. C., Chicago; V. V. Holmberg (vice-chairman), supvr. b.&b., C.&W.I., Chicago; K. J. Weir (vice-chairman), supvr. fuel & w. s., C.M.St.P.&P., Chicago; G. B. Davis, supvr. b.&b., N.Y.C., Columbus, Ohio; C. A. Hughes, supt. b.&b., E.J.&E., Joliet, Ill.; C. R. Knowles, supt. w. s. (retired), I.C., Chicago; W. J. Martindale, br. fore., T.H.&B., Hamilton, Ont., Canada; John Millgren, w. s. fore. (retired), C.&N.W., Eagle Grove, Iowa; L. R. Robinson, president, Pittsburgh Pipe Cleaner Co., Pittsburgh, Pa.; J. C. Runyon, supv. trk., C.&O., Covington, Ky., and E. W. Scott, asst. div. engr., Erie, Buffalo, New York.

B. & B. SECTION

Adapting Turntables to Meet Modern Conditions

Report of Committee

MANY railroads today are finding it necessary for their turntables to accommodate heavier locomotives with longer wheel bases than those for which the turntables were originally designed. The longer wheel bases make it difficult in some cases to balance the load properly, thus adversely affecting the operation of the tables. The transfer of many former main-line locomotives to branch lines and the use of still larger ones on main lines has severely taxed many tables that were not designed for the loads now imposed on them, throwing excessive loads on the steel structure, the centers and the circle.

The two prevalent types of turntables are the balanced and three-point types. The balanced-type table will handle locomotives advantageously only when the locomotive can be balanced on the table. The increased use of Diesel locomotives and similarly-constructed types, in which the wheels are spaced far apart, has increased the problem of operating and maintaining balanced-type tables. Often in moving such a locomotive onto the table, the lead trucks pass the center support before the trailing trucks reach the table, thus causing the approach end to rise and allow the trailing wheels to strike the ends of the rails. This tends to drive the rails toward the other end of the table, and also causes a thrust against the turntable center, which increases maintenance costs and the possibilities of failure. In some cases it is impossible to balance locomotives properly on balanced-type tables due to the distribution of locomotive weight and wheel spacing. Where this is the case, the only positive remedy is to convert the table to the three-point bearing type.

H. M. Harlow
Chairman

Balanced-type tables up to 120 ft. in length are in use. Three-point type tables range in length up to 135 ft. The length of the turntable should be somewhat greater than the longest locomotive which it will be required to handle to allow some room for adjustment of the position of the locomotive to distribute the load properly, keeping in mind that no part of the locomotive should project beyond the end of the table. Where dead locomotives are handled across a turntable by switch engines, the table should be long enough to accommodate the full length of both engines without the necessity of detaching the tenders.

Turntable Decks

The decks of all turntables should be made tight enough to keep dirt and other debris from the steel and trucks, and of sufficient strength to support the loads properly. One railroad recommends a solid timber deck built along the following lines:

"Decks on turntables should be constructed of treated timbers, at least 8 in. thick, laid tightly together to protect the main girders, floorbeams, and end trucks from dirt and cinders; also from rainfall

and the drippings from locomotives, with drain holes provided at suitable locations. Manholes should be provided in this solid-type deck to afford access to the center and end wheel bearings. These holes should be covered with removable steel plates. Suitable treated timber shims are to be placed between the bottoms of the deck ties and the top flanges of the main girders. The top flanges of the main girders, cross girders and floorbeams should be protected by a non-corrosive sheet metal inserted above or below the timber shims. These strips should be from 6 to 10 in. wider than the top flange cover plates and the excess width should be bent downward on each side to provide full protection to the steel.

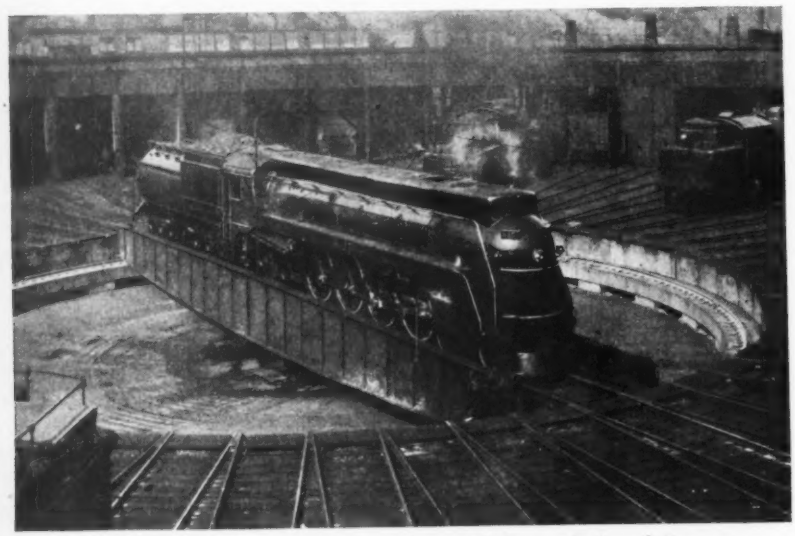
"At each end of the table, where the wheel impacts are highest, an H-beam or steel end tie should be provided. At important terminals, where tables are in constant use, three H-beams or steel end ties should be provided at each end. To minimize the effects of derailments on turntables, guard rails 4 ft. long, and of the same weight as the deck rails, should be installed at each end and provided with foot guard blocks and other necessary fittings. The positions of the deck rails should be secured by means of four long strap rail anchors, each anchor to consist of a steel bar, approximately 2 in. wide by ¾ in. thick by 8 ft. 6 in. long, bolted rigidly to the web of the deck rail and to the deck timbers.

"Deck-girder tables should be provided with timber handrails and posts. Truss spans may be provided with cable handrails, fastened to the end posts, center posts, and hip verticals by means of cable clips."

The solid timber deck is considered excellent. If the protection which it is designed to provide is not sufficiently urgent to justify the expense of such protection, the ties can be spaced on wider centers and covered with shiplap or tongue-and-groove decking to keep dirt from sifting through the dock.

Rail locks of a positive type are essential in the operation of turntables. For balanced tables with considerable vertical movement at the ends, a sliding tongue on the table may engage a U-shaped forging on the pit wall. On three-point-bearing tables, where the ends do not change elevation, holding may be done by a member sliding from the table rails and engaging the approach rails in the web just under the head, thus eliminating the expense of additional parts and assuring correct alinement between the rail ends. These engaging members should be provided at both ends of the table if the rails do not line up from one side of the table to the other.

Each locking member can be controlled from levers adjacent to, but not inside, the operator's cab. It has been found that turntable operators sometimes use the locking device to stop the table, which places an unnecessary strain on both the table and radial track rails. By placing the rail lock levers outside the cab, this tendency can be controlled. To operate the lock at the far end of the table, a small diameter pipe line, supported on brackets at the side of the table, may be used. Where shafts are used in connection with levers at the ends of the table, antifriction bearings should be employed and all surfaces should be kept well oiled so that the locking mechanism will operate with minimum effort. If found desirable, limit switches may be incorporated in the design, making it impossible to apply power except when the lock is disengaged. Also included may be signal lights at the ends of the table, which indicate red at all times, until the lock is engaged, when they will change to green.



A Three-Point-Bearing Turntable as Converted from a Balanced Structure

Types of Drives

The power mediums for turning tables are electricity, air and gasoline motors, the first named being the most satisfactory where electric power is available. Air motors are sometimes used on unimportant tables or as emergency power on important electric-powered tables. Air motors may be operated entirely independent of outside power sources by taking the air from the locomotive being turned.

Balanced-type tables may be turned satisfactorily by a tractor connected to one end of the table, unless the locomotives are of such weight or length as to cause an unbalanced load and severe friction on the truck wheels at either or both ends. In such case, it is necessary to counterweight the tractor or to add a second tractor to the opposite end. Care should be taken to maintain the wheel bearings to the highest degree of workability.

Three-point-bearing tables are commonly powered by two electric motors at diagonally opposite corners of the table, each geared to a drive wheel and integral with the trucks. The design should be such that both driving wheels will bear on the circle rail, irrespective of the position of the locomotive on the table. The motors should be of sufficient capacity so that, in case of failure of one motor, the other will handle the table satisfactorily without undue overheating. A duplex reversing and variable speed drum controller should be used to control either or both motors. Grid resistors of cast iron or edgewound steel should be employed, together with an overload and low-voltage panel. These necessary items may be arranged in one cabinet fully wired, thus reducing the time out of service for installation.

The current collector at the center of the table should be placed overhead on an arch of standard clearance, and should be of sufficiently heavy construction to eliminate back-guying. This arch should be supplied with a ladder and inspection platform. The collector housing should be rugged and as nearly water and smoke-proof as possible.

Turntable brakes should be maintained at a high state of efficiency. This should lessen any tendency on the part of the operator to plug or reverse the motor to stop. Electric brakes are procurable in thruster, magnetic or solenoid types. Also, hydraulic and mechanical brakes are used extensively. The last named type gives the best performance generally, as it is less affected by shocks and vibration and is simpler to maintain.

Speed at the end of the table should be 150 to 200 ft. per min. A faster rate will often cause passing of the spotting point, requiring reversing and unnecessary operations.

Circle Rails

Circle rails of 90-lb. or 100-lb. rail are recommended for balanced-type tables, and 131-lb. rail or 175-lb. crane rail for three-point support tables. A firm support in the track area only is generally sufficient for the circle rail of a balanced-type table. Timber bulkheads on piling or on suitable bearing material are sufficient at locations where tables are used infrequently. Wood ties embedded in masonry, supported on piling or on other firm support, are recommended at important engine terminals. For three-point-support tables, a full circle wall of masonry construction, supported on piling or other firm support, is imperative to insure re-

liable service and to avoid high maintenance costs. The circle rail should be placed on steel plates rather than directly on the wood ties.

For balanced-type tables, when wood ties are used, standard tie plates, track spikes and rail fastenings afford suitable anchorage. For three-point-support type tables, the anchorage offered must hold the circle rail to true surface and alinement at all times. Unless positive anchorage is afforded, the heavy loads on the circle rail and anchorage, together with corrosion and wear of the bearing plates, clips, wedges, clamps, and anchor bolts, will result in the circle rail getting out of line and surface. Adjustments are difficult and are often delayed, especially at important terminals, until the situation becomes critical. The importance of keeping the circle rail fastenings tight cannot be over-emphasized as most of the trouble experienced with circle rails can be traced to lack of proper maintenance of these fastenings.

To avoid high maintenance costs, the circle-rail support should be proportioned to the frequency of use and class of power turned, with anchorage that is positive, yet readily adjustable. Bearing plates should be of sufficient size and spaced close enough together to prevent excessive maintenance.

Welded joints for circle rails of sections 100-lb. and heavier are feasible and have certain advantages over bolted joints. The welded joint does not require a different type of support than at other points of the circle rail, whereas bolted joints do, and creeping of the rail from the established points of joint support is, therefore, not significant. Line and surface of the welded joint is less troublesome to maintain than the bolted joint, because the tendency of the bolted joint to straighten and cant outward is overcome in the welded joint.

The replacement of broken and damaged rails, in the event of an accident, however, is simpler if the joints are bolted, unless welders and welding equipment are immediately available at all times at the turntable.

Radial Tracks

At most turntables, there is a definite movement toward the circle wall of the radial and lead track rails. When the rails move to such an extent that they foul the table rails, the line of least resistance is usually followed, of cutting off the ends of the rails, which may have been end hardened. To prevent this movement of the radial or lead rails, or to reduce it to a minimum, it is recommended that all radial and lead tracks be properly maintained with a full ballast section and that the rails be anchored according to main-line practices or standards. The rails of radial and lead tracks may be fastened to the rim girder or circle wall by the installation of 100-per cent angle bars, with the bases of the bars fitting snugly against the outside of the rim girder or wall, or by the installation of rail anchor bars securely bolted to the webs of the rails and adequately fastened to at least six ties.

Good surface of the radial tracks is necessary to prevent excessive strain on the fastenings at the circle wall. Often the track ties immediately behind the circle wall cannot be tamped properly, resulting in surface bending of the rail. In such cases a concrete mat or a grouted ballast section is recommended to support the radial tracks. This type of support has proved satisfactory and has reduced much trouble with radial tracks.

The steel and bearing details at the ends of the table span, as well as the tracks supported on the coping timbers or circle wall, are subject to repeated impact shocks and frequent hammering by locomotive and tank wheels when coming on or leaving the table, resulting in fatigue failures, as well as damage to the end wheel bearings. To reduce these shocks, shock-absorbing material, consisting of vulcanized layers of cotton duck and rubber compound, has been used. This material can be placed between the bottom of the rail or rail plates and the tops of steel ties or bearing plates at the ends of the table, and on the circle wall. It must be fixed securely in position, preferably by means of plates or ribs, acting as shoulders, welded to the steel ties or bearing plate.

Shock absorbing materials have also been used with satisfactory results by several roads at other points of contact where shock and impact are severe but experience with this method of reducing shock is not sufficiently widespread to permit definite conclusions to be drawn.

Conversion Details

The conversion of balanced to three-point-type tables may be accomplished by the use of two heavy electric tractors at diagonal corners of the tables and the application of roller-bearing wheel assemblies at the ends. However, a preferable method is to install new end trucks with electric drives, integral with and geared to two wheels at diagonal corners, wherein a large part of the load is utilized for traction. Truck frames should be of heavy section to withstand excessive impact, and the wheels should be forged steel with hardened treads. The treads should be flat and up to 6 in. wide to secure full bearing under slight eccentricities in the radius of the circle rail. The wheels should be of as large diameter as is consistent with the general design and space available. With the use of driving trucks, an operator's cab to house the duplex control will be mounted on brackets at the side of the table at one end. Convenience and safety require that the cab be placed at the end of the table at a distance approximately 6 ft. from the circle wall. Wood construction with heavy canvas back roofing is generally preferable.

Converted tables may be considered as two spans, with a proportionate reduction in the load on the center and the table girders. Most all girder tables can be converted without reinforcing, and may also be extended, if necessary, to accommodate longer locomotives. Existing turntable centers, if in good condition, may be continued in use. These may be of the bronze disc or roller type without noticeable difference in friction. The latter, being lubricated with grease, should be filled to the top to prevent the entrance of water and dirt. Where oil is used to lubricate disc centers, the centers should be well sealed so that a film is maintained over all wearing surfaces.

B. & B. SECTION

Two or Four Wheels

The general practice in the past has been to use four wheels at each end of turntables. However, installations have been made occasionally with only a single two-wheel rigid truck at each end of the table, not only in the case of light balanced tables, but, recently, for a 120-ft. three-point-bearing type, heavy-duty table, which is reported to be giving satisfactory performance.

Considering only the table proper, the initial cost of the two-wheel installation will be less than for the four-wheel installation, and to a greater degree where the wheels are equipped with large capacity roller bearings. On the other hand, the wear on the circle rail and wheel treads will be much greater for the two-wheel installation than for the four-wheel installation. To give an idea of how loads affect wear, we can draw on the experience of the roller bearing manufacturers, who have found that the useful life of a roller bearing varies inversely as the cube of the load. This rule, if applicable to all types of rolling contacts, would indicate that the circle rail, wheel treads and roller bearings, would wear out eight times faster for the two-wheel installation than for the four-wheel installation, assuming the same size rails, wheels and bearings for both types of installation. It is sound reasoning to expect this theory to apply and to conclude that four-wheel ends are more desirable than two-wheel ends. Accordingly, the four-wheel ends are recommended when the difference in cost of installation is not too great to make them uneconomical. Any feature which reduces friction and loading on any moving part of a turntable is definitely desirable.

The turntable circle wall should be built of concrete, designed and maintained to provide proper strength. The turntable pit should be paved with reinforced concrete, 6 in. thick, with adequate expansion joints. The surface of the pit should be constructed with proper slopes and valleys to provide for quick drainage. In all cases, a study should be made of local drainage conditions at the turntable so that proper catch basins, sumps, and drainage systems can be installed. It is considered good practice to provide headroom of 12 in., or more between low steel of span and the top of the concrete paving for snow clearance.

As it is frequently necessary to jack up a turntable span for repairs or inspection, four concrete jacking pits should be constructed when the pit concrete is being poured. A height of 30 in. is necessary between the bottom of the steel span and the floors of the jack pits to provide head-

room for the average jack, with a wood shim above and below the jack. The inspection pit, or bay, in the circle wall should be of adequate size to allow two mechanics with necessary tools to work, and should be located in line with the jacking blocks.

A serious difficulty experienced with some much-used and heavily loaded turntables has been the tendency of the truck wheels to travel in a tangent off the circle rail, and subsequently to jump back to line with a snapping action. This produces a severe strain and shock on the entire truck system and on the circle rail and fastenings. This can be controlled to some extent by the installation of rods, or bars, with turnbuckles, from the ends of the truck frames to the girders. A large turntable manufacturer has adopted the standard practice of tilting the truck wheels slightly toward the center of the table, so that the axles produced intersect on the vertical axis of the center pivot in the horizontal plane of the top of the circle rail. This method permits coning of the wheels. Unless the truck is tilted, the coning of the wheels increases the tendency of the wheel to travel in a tangent off the circle rail.

The inspection of turntables at regular intervals by representatives of all maintaining departments is necessary, and responsibility must be definitely established as to maintenance, including lubrication, cleaning, keeping circle rail properly adjusted, and all other necessary operations. It is considered good practice to maintain a suitable stock of replacement parts for emergency use, such as spare trucks, at least a portion of the circle rail, bearings and other items.

In conclusion, it can be said that modern conditions are placing greater responsibilities upon the maintenance officer, and are drawing more and more upon his ingenuity to adapt existing turntables to meet the needs of the future. New tables, ideally designed to suit immediate needs, are not often readily obtained, and, from an engineering standpoint, it is not good practice always to solve problems of inadequacy in old facilities by replacing them with new facilities. Rather, wherever possible, it is the duty of railway officers to make old facilities meet the new requirements. This is being accomplished in the case of turntables by the conversion of balanced-type tables to three-point type tables, by lengthening tables too short for requirements, and by strengthening others, as well as the replacement of generally obsolete features with improved parts.

Discussion

H. M. Church (C.&O.) stressed the importance of using solid timber decks on turntables. H. T. Livingston (C.R.I.&P.) said that on his road wedge-shaped timber members are placed between the ties over the girders to protect the metal surfaces from corrosion. Stating that turntables are machines and not bridges, he urged that the mechanical forces be given instructions for oiling and cleaning them and for the proper operation of locomotives over them, the latter to include a prohibition against opening locomotive pet cocks over turntables. In maintaining a suitable stock of spare parts, he cautioned that trucks and motors, being expensive, should not be stored at all points where turntables exist, but only at a central point on the system. He questioned the use of cabs for turntable operators, reasoning that better vision can be had without them. If cabs are provided, he said, they should be placed at the centers of the tables.

Committee Personnel

H. M. Harlow (chairman), asst. gen. supvr. b. & b., C. & O., Richmond, Va.; A. E. Bechtelheimer (vice-chairman), engr. of br., C. & N. W., Chicago; F. H. Cramer (vice-chairman), br. engr., C. B. & Q., Chicago; Lee Mayfield (vice-chairman), asst. engr. str., M. P., Houston, Tex.; A. B. Chapman, engr. & supt. b. & b., C. M. St. P. & P., Chicago; C. C. Eubank, asst. supvr. b. & b., C. & O., Huntington, W. Va.; J. S. Hancock, br. engr., D. T. & I., Dearborn, Mich.; A. R. Harris, asst. engr. of br., C. & N. W., Chicago; E. M. Hastings, ch. engr., R. F. & P., Richmond, Va.; R. W. Johnson, asst. engr., C. M. St. P. & P., Chicago; A. S. Krefting, prin. asst. engr., Soo Line, Minneapolis, Minn.; R. E. Paulson, ch. drafts, C. M. St. P. & P., Chicago; T. H. Strate, div. engr., C. M. St. P. & P., Chicago; and W. A. Sweet, gen. fore. b. & b., A. T. & S. F., Newton, Kan.

Methods of Improving Strength, Durability and Wear Resistance of Concrete

Report of Committee

THE railroads, public utilities and governmental agencies are now having to spend large sums of money to repair concrete masonry that was originally thought to be practically indestructible. One major railroad estimates that it has spent $3,000,000 during the past five years to repair or replace disintegrated concrete, and that an expenditure of an additional $1,000,000 will be required for similar work within the next five years. Another railroad, with less mileage, estimates that $200,000 will be required to be spent in the next five years. One railroad has already spent $300,000 to repair its concrete grade separation structures in one city alone. Several roads estimate they will have to spend around $100,000 a year on concrete repair work until such time as their necessary repairs catch up with disintegration.

The concrete enthusiast may think that all of the defective concrete referred to was placed before the water-cement ratio gained prominence. Such is not the case. One railroad reports that the present bid price for replacing defective concrete in 35 bridge structures, built between the years 1928 and 1930, is $100,000. The concrete for these structures was designed for 2,500 to

J. S. Hancock
Chairman

3,000-lb. concrete in accordance with the water-cement ratio theory in effect at that time, using well-graded aggregates and designed and placed under close supervision. Test cylinders showed strengths equal to or in excess of the designed strength. Abutments and walls were waterproofed on the back side and were backfilled with crushed stone drained by vertical and horizontal drains. The sad part of it is that no one has been able to determine the exact cause or causes of this disintegration.

Attention is called to the fact that several monumental concrete dams built within the last few years are already showing serious disintegration. The Parker dam, for example, was completed in 1938 by the U. S. Bureau of Reclamation at a cost of $6,000,000. Within 2 years' time it was found to be seriously disintegrated and experts do not yet agree as to the exact cause.

Most of the members of this Committee are construction men who have been in charge of placing concrete for a long time, and who have also had to remove or patch considerable concrete. None of us claim to be concrete experts. The average construction man has little, if any, time for research or investigation. You might say he is "on the firing line." He takes the plans, specifications and materials furnished him and develops them into a finished product to

the best of his ability and at the least possible cost. We are perturbed about the lack of durability of concrete, and we claim that we have a right to be perturbed when some of us see concrete we placed with pit-run, unwashed gravel, having say 60 percent sand and 40 percent pebbles mixed and placed by rule of thumb by unskilled men in unfavorable locations, outlast concrete placed more recently under present-day rigid specifications.

Inherent Weakness

The inherent weakness of concrete as a building material, aside from the fact that one or more of the materials used in its manufacture may be defective, is that it involves innumerable opportunities for something to go wrong or for someone to do something wrong before it is actually mixed, poured, cured and ready for use. One mistake or omission may be all that is required to impair seriously the strength and durability of the finished product.

For instance, let us assume that a rush contract building job is under way. The specifications for the concrete are A-1; the cement and concrete materials delivered to the job are the best that could be desired; and we believe that everything is in readiness to pour a 100 percent perfect concrete floor. The concrete finishers then arrive on the scene and demand that the concrete be delivered with an excess of water, otherwise they will walk off the job. They expect to get the overtime pay while waiting for the concrete to dry out, or else.

Put yourself in the inspector's shoes and decide what kind of a floor that building owner is going to get. You say "that cannot happen here," but it has happened here. Until such time as the owner, who foots the bills for concrete maintenance work, and all of us who design and build concrete structures, wake up to the fact that durability of concrete is more important than the strength of concrete, the reputation of concrete as a durable building material will remain in danger.

As long as strength was considered the desirable feature to be obtained in concrete and we learned that the desired strength could be obtained by controlling the water-cement ratio, everything was rosy for the architect, the engineer, the cement manufacturer, the aggregate supplier and the contractor. We had something we could see and get our teeth into. We made 7-day and 28-day cylinders, crushed the cylinders, found that the correct strength was there, and everything was fine. We were all "authorities" on concrete. Now, 15 years later when this same concrete is showing serious disintegration and sizeable expenditures are required for repairs, the maintenance engineer finds these former "concrete experts" rather hazy in their recollections as to exactly how concrete of such inferior qualities was made.

Many Disillusioned

For several years many of us have been disillusioned with the water-cement ratio theory. We labored under the general opinion that too much water was the sole cause of all poor concrete. When inspecting any disintegrated structure built before this theory came into effect, we have taken one look at the structure and shook our heads knowingly with the remark, "too much water—it's a wonder it has stood up this long," and walked off. Now we may have to inspect a disintegrated structure on which we designed the mix ourselves in accordance with the water-cement ratio theory, using what we thought were A-1 aggregates, properly proportioned, and on which we know the test cylinders were satisfactory. This is an embarrassing moment, and probably the time when we must admit, at least to ourselves, that we are not experts on concrete.

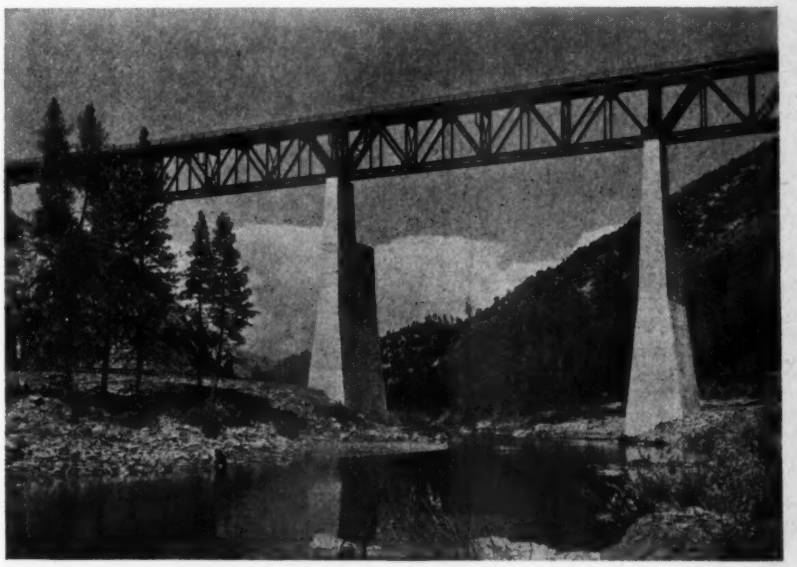
Possibly the early users of steel had about the same trouble with that material that we are now having with concrete. Steel is now made under the direction of expert technicians, with close control from the raw material to the finished product. The field and laboratory control of concrete should be under experienced men comparable with those of the steel industry. In addition to a "definite strength" concrete, we believe that specifications should call for a "definite life" concrete, say a 3,000-lb., 35-year life concrete, or whatever strength and life is desired, with the reasonable certainty that the cement and aggregates, if mixed, placed and cured properly under expert supervision, in accordance with the specifications, will give that strength and life. Every laboratory testing concrete materials should have specialized technicians who, after making the necessary tests on the cement and aggregate, and knowing the conditions under which the concrete is to be used, can estimate closely the life of the concrete to result from the materials tested. The one who furnishes the money for the construction is entitled to know what life concrete he is going to get. Perhaps 20-year concrete is all he wants. However, if he wants 50-year concrete, he should know that he is going to get it, and what it will cost.

It is not uncommon practice to specify that the inspection of the concrete materials, as well as of the mixing and placing on the job, be taken care of by an approved laboratory at the expense of the contractor, and that the cost of this inspection be included in the contractor's bid price for the concrete. Under such a set-up, the laboratory is faced with the possibility that if it rejects any materials or workmanship, it stands the chance of not being employed on further work by the contractor. In some instances, when the railroad's field staff is inadequate, a railroad contractor will carry the concrete inspector on his own payroll. In such cases, those in responsible charge are evidently reluctant to forego all concrete inspection and, at the same time, are desirous of burying the cost of such inspection. In such cases, the owner still pays the full price, but stands a poor chance of obtaining good inspection.

Unless the concrete materials to be used have already proved their durability in actual use, or the railroad, or the owner, carries a competent staff of concrete technicians to do the work, all concrete materials and mixing and placing should be in the hands of a competent laboratory, experienced in concrete work, and employed by and directly responsible to only the railroad or the owner. And here again, we say that the laboratory should be both competent and willing to deliver concrete of the life the railroad or the owner specifies. We believe that by now these laboratories are fully cognizant of the fact that the ills of concrete are many, but we insist that laboratory personnel, or, for that matter, any of us do not regard our responsibilities less seriously by reason of the fact that even poor concrete will last 15 or 20 years, when we will be on other work.

Much of the information contained in

B. & B. SECTION



Modern Railroad Bridge With Concrete Piers

this report was obtained through a questionnaire sent to railroad men and representatives of other organizations, all of whom are well experienced in concrete manufacture. Replies were generous and the committee is appreciative of the assistance given.

This report covers only concrete that is exposed to weathering, freezing and thawing. Little will be said about strength, as we consider that the water-cement ratio theory and grading requirements that have been in effect for several years—with which you are all familiar—definitely control the strength of concrete. We are most concerned with durability, without which strength and wear resistance are unimportant. Many of us would gladly trade 1,000 pounds per square inch in our concrete strength for another 10 years of durability.

Many railroads have their own concrete specifications, and those who do not, use A. R. E. A., Portland Cement Association, or American Concrete Institute specifications, all of which are very good. One railroad prefers the National Crushed Stone Association's Bulletin No. 11 for proportioning. We will not discuss details of mixing, placing, etc., which are already covered in the specifications you use, and with which you are all familiar.

What Should Life Be?

In our questionnaire we asked, "In your opinion, what should be the life of a well-designed, well-placed and well-cured concrete, exposed continuously to weather in the northern part of the United States, using 5½ gal. of pure water per bag of cement, with a good grade of hard, crushed granite or trap rock for coarse aggregate and pure silica sand, with adequate fines, for fine aggregate, using Type-I Cement meeting present-day specifications?" Typical replies read, "No limit—better with age"; "80 years upward"; "60 years"; "50 years or more"; "indefinite"; "a lifetime."

To a question as to how one would alter or improve the above concrete to obtain longer life, the general opinion was that this concrete could be improved by being properly drained, and the exposed surfaces waterproofed against seepage water. This would give a concrete made from durable, inactive, non-laminated, non-absorbing aggregates, well drained and waterproofed against moisture. If the aggregates available to you in your territory approach the above in durability and non-absorption, and your workmanship is good, you are indeed fortunate, and you should have no serious trouble with your concrete.

To some, this might seem to be the answer to the complex question of how to obtain durable concrete. The quality of the aggregates used certainly do play an important part in obtaining sound concrete.

Comments on Aggregates

In preparing this report, it was interesting to note the comments relating to aggregates. One state department reported that it has used trap rock extensively and has had no serious trouble with concrete disintegration. Another report on a 35-year pavement, without disintegration, in which quartzite was the coarse aggregate. Trap rock is not subject to laminations, is tough and non-absorbing. It has an absorption of 0.34 percent in 3 hours as against 1.19 percent to 1.62 percent for limestone, 1.17 percent for gravel, and 2.54 percent for slag. However, most of us believe that just as satisfactory concrete can be made from other aggregates if the proper precautions are taken to obtain sound materials. This is fortunate, as we are, of course, obliged to use the highest quality of materials that are economically available, the quality to be judged by close observation and tests of the component parts, as well as the finished product.

Laboratory Tests

Accelerated laboratory tests of concrete and concrete materials that will duplicate actual field conditions, have not yet been developed. When we consider that one of the main constituents of cement starts to hydrate immediately and completes hydration in about 28 days, while another equally important one does not start hydration for several days and continues hydration as long as water is present, we have some idea of the difficulties of laboratory tests duplicating field conditions. In the case of the Parker dam, it was found that at the time the outer shell was shrinking with progressive drying, the interior concrete, where the residual mixing water was still available, was swelling.

Cement

When the ingredients of portland cement are burned at a high temperature and then cooled, they combine and form tricalcium silicate, dicalcium silicate, tricalcium aluminate and tetra-calcium alumine ferrite, with small amounts of calcium sulfate, magnesium oxide and alkalies. The combining of these compounds is largely affected by the time and temperature of burning and the rate of cooling.

In the mixing of cement and aggregates to make concrete, the hydration of tricalcium silicate starts immediately, is about complete in 28 days, and is responsible for early strength, accompanied by considerable heat. The dicalcium siilcate does not start to hydrate until several days after mixing and continues hydration indefinitely in the presence of water. Tricalcium aluminate is responsible for early strength, generates high heat, is responsible for excess expansion, is most affected by aggressive water, and is responsible for several of the undesirable qualities of cement.

We know that cements are not alike, although they meet a certain definite specification. To the construction man, the standard A. S. T. M. specification for chemical requirements for Type-I cement, which is the type most universally used, is conspicuous by its failure to place any limit on but 4 of a possible 11 limitations. To this man, it would seem that almost anyone could make Type-I cement, although plant chemists assure us that such is not the case. Be it as it may, it seems to us that the chemical requirements for Type-I cement should be more comprehensive, as Type I is the cement most universally used.

A. S. T. M. Type-II cement is more closely controlled than Type I. It is lower in tricalcium aluminate, which results in reduced heat, with less volume change and greater resistance to alkali water. This type cement is used extensively on Bureau of Reclamation work in place of Type I, and we believe it deserves your consideration for future work, particularly for massive sections, where considerable heat will be generated.

Type-III high-early-strength cement is used on emergency work where early high strength must be obtained. Its high content of tricalcium aluminate, required for early strength, is not conducive to durability.

Type-IV low-heat-cement and Type-V sulphate-resisting cements are special cements to meet special field conditions, as indicated by their designated names.

Keep Cement to Minimum

The cement content of concrete should be kept to a practical minimum. It is the most unstable of the concrete materials. It generates heat with accompanying contraction and expansion, changes in volume with moisture, and is subject to action by active water. Also, if the cement contains excessive free lime or alkali, any cement over and above the minimum required means that the resulting concrete will contain more of these undesirable substances. Surely there is no good reason for an excess of cement, although this is one of the most common abuses of the material. We frequently use a little more cement than we think is actually required, just to play safe.

Starting about 1940, a lot has been said about the disintegrating reaction between cements high in alkali and certain aggregate in the Northwest. The excess alkali in cement is considered as a rover that has not become fixed by being incorporated in the cement, and reacts destructively with some type aggregates. The finer the cement, the easier the alkali is released. Opaline silica is the one constituent of aggregates which, practically all agree, reacts unfavorably with high-alkali cement. A well illustrated article relative to this and other types of disintegration is to be found in Public Roads, Volume 24, No. 4 of April, May and June, as reported by F. H. Jackson, principal engineer of tests, Public Roads Administration. This disintegration, prevalent in the Northwest and West, appears more serious and pronounced than in the central states, where we believe our worst trouble comes from freezing and thawing. However, if there is any doubt as to the cause of your trouble with concrete, we recommend that you limit the alkali content of your cement, at least until such time as your aggregates are definitely pronounced non-reactive, as only 2 percent of reactive aggregates is enough to cause trouble.

Aggregates

Unsound, improperly-graded and segregated aggregates just about top the list as the cause of poor concrete. Unless your fine and coarse aggregates have already proved their durability in actual construction, they should be thoroughly investigated by sodium or magnesium sulphate soundness tests, or freezing and thawing tests, or

both. Even if they have already proved their durability, there may be some doubt as to their reliability when used with present-day cement. Considerable importance is now being given to freezing and thawing tests on concrete test beams to determine their loss in flexural strength after several cycles of freezing and thawing, as flexural strength is more sensitive to freezing and thawing than compressive strength.

Trap rock and granite head the list as preferred coarse aggregates. However, sound, well-graded gravel, dolomite or limestone, and blast furnace slag, are considered satisfactory if they meet present-day specifications. Low absorption and high specific gravity are indications of sound aggregates.

Chert, shale and unsound particles are the worst offenders in gravel. Chert has all the appearances of a sound stone and, for that reason, is particularly treacherous. Some cherts are satisfactory for use, and we doubt if unsound chert can be distinguished from sound chert, except in the laboratory. Chert with a specific gravity below 2.35 is considered as definitely unsound. Shale should be kept to a minimum, as it disintegrates from weathering.

Dolomite is considered as tougher and harder than low-magnesium limestone. Both of these stones, when freshly quarried and exposed to the air, are subject to deterioration. Railroads are careful to select stones that are not subject to laminations, as some poor concrete is directly traceable to this defect. Most railroads prefer that crushed stone be washed. Excess dust on the stone is an indication that the stone is too soft. Sandstones are frequently friable or excessively porous because of imperfect cementation of the grains. Blast furnace slag is used extensively by highway departments, particularly in pavement work. It is more resistant to sulfate action than some stone. However, some railroads consider it too porous and subject to pop-outs.

Sand

In selecting sand, care should be taken to see that the grains are solid particles. Grains that are formed by the cementing together of many smaller particles tend to disintegrate.

Sand should be washed. The closer sand is to pure silica, the better. Sands high in silica, felspar and calcium carbonate will absorb very little moisture. Care should be taken to see that 12 to 30 percent by weight will pass the No. 50 sieve and 3 to 10 percent the No. 100. As most sands, when washed, do not contain this high a percentage of fines, it is often necessary to add additional fine sand. Sand manufactured from stone is not considered satisfactory. Natural sand taken from a pit where the gravel contains excess chert, or other deleterious substances, should be very carefully investigated. Only enough sand should be used to give a workable mix. Any sand over the required amount automatically adds more water to the mix, which is undesirable.

It is desirable that laboratory tests be made of all cements and aggregates available to your railroad, and that this information be readily available in order that the most suitable materials may be selected for any particular job without undue delay. You will not go wrong in specifying that aggregates meet A. R. E. A. or local state highway department specifications.

Curing

In curing is where most of us fail miserably in our efforts to obtain good concrete. When we consider that one of the main constituents of cement does not even start hydration for several days after pouring, and then only in the presence of water, and that from 50 to 75 percent of the effectiveness of the cement is lost if curing is stopped too soon, we can better understand why curing is necessary. Inadequate curing may affect only the outer shell of concrete, as farther inside the mass the retained water may be sufficient for curing. However, this internal concrete robs moisture from the outer shell, and if the outer shell does not have sufficient water, it will shrink while the inner concrete is expanding, causing the outer shell to check and crack seriously, and thus reduce the life of the concrete. Concrete expands and contracts with wetting and drying. The old method of applying curing water with a hose, then permitting the sun to dry out the concrete before applying water again, contracts and expands the green concrete until this outer shell, one might say, is "all worn out" before it is even ready to use. Both the amount of moisture for curing and the temperature of the concrete should remain as constant as possible.

Excess water is necessary for cement hydration. Theoretically, the curing should continue for several months. As this is impractical, it should be continued for not less than 7 days and, if possible, 14 days.

Curing compounds are now on the market and, in some instances, as when concreting close to electrical work, are absolutely necessary. However, we are of the opinion that there is no substitute for excess water, which must be present in order for the cement to hydrate.

The freezing and thawing of concrete while in a saturated or near saturated condition is another predominant cause of disintegration. To resist this, the concrete should be dense, with the coarse aggregate having a co-efficient of expansion as close as possible to that of the cement mortar, and non-absorbing in character, and using as low a water-cement ratio as possible to obtain a workable mix. In addition, the surface water must be kept out. If it cannot be kept out, it must be drained away quickly.

All horizontal exposed surfaces should be pitched to drain the surface. In addition, the top surfaces of bridge seats, wing wall, retaining walls, etc., should be thoroughly waterproofed to keep water from soaking in.

The backs of all walls must be drained and waterproofed. The form for the back of abutments and walls can be moved back two or three feet and left in place, the space between it and the masonry being filled with coarse crushed stone, inside which a complete horizontal and vertical drainage system is built. The prime coat of waterproofing should penetrate the pores of the concrete to be effective. Hot tar and asphalt, or tar and asphalt emulsions with suitable primers, are effective waterproofings for the back of walls. A prime coat of hot 50 percent turpentine and 50 percent raw linseed oil, with a second coat of hot, raw linseed oil, is effective for top surfaces, over which a good oil base concrete paint may be applied, if required.

An Example of Disintegration at the End of a Concrete Wing Wall

Air Entraining

It is thought that the use of air-entraining concrete may prove to be a greater asset to concrete durability than the development of the water-cement ratio theory. A. S. T. M. specifications are in force covering the use of both vinsol resin and Darex as air-entraining agents. Other air-entraining and dispersing agents are in use and are proving satisfactory. However, as yet, no authoritative specifications covering them are available, which limits their use.

Air-entraining cement may be purchased, or the agent may be added at the mixer. At the present time, it is recommended that it be added at the mixer.

B. & B. SECTION

Although air-entraining is still somewhat experimental, insofar as its use in structures is concerned, we think you should give it a trial in your structures. It will decrease somewhat the strength of rich mixes, but will increase the strength of lean mixes. Bond strength will be somewhat reduced. The water and sand content of the concrete, however, can be reduced, and workability and segregation of aggregates will be much improved, and bleeding reduced.

General

Following are some of the things the various railroads are now doing to improve their concrete, listed approximately in the order of their importance:

(1) Better selection and grading of aggregates.
(2) More care to prevent segregation.
(3) More attention to water-cement ratio and better water control.
(4) More careful curing.
(5) Better and more careful supervision.
(6) Specify compactness. Slump held as low as possible.
(7) Watch fine aggregate to get 10 to 30 percent passing No. 50 sieve and 2 to 10 percent passing No. 100 sieve, with fineness modulus of 2.40 to 2.80.
(8) Use only weight proportioning.
(9) Waterproof and drain backs of all abutments and walls, and waterproof top surfaces of all piers, abutments and walls.
(10) Indicate all pours and joints on the plans.
(11) All pours in one operation.
(12) Remove and waste top of pour after concrete has been in place long enough for the fines and laitance to come to the top.
(13) Better attention to details.

Much poor concrete is at construction joints. Joints should be detailed to keep water entirely out of and away from these joints. Concrete is often dumped into the form and worked toward the joint. Due to segregation and bleeding, an excess of water thus collects at the ends, resulting in concrete having less weather resistance at these points. Actually, the concrete should be kept slightly higher at the ends of the sections than at the middle.

On thin sections, leave an open joint. Tongue and groove joints in thin sections are not desirable. An effective water stop, caulking, or waterproofing applied over a joint at the back of a wall, is considered more effective than a lead or copper waterstop inserted in the wall. All vertical joints should be caulked or waterproofed across the top to keep moisture from getting into the joint from above. In any case, keep the water out or get it away fast. It is saturated concrete that disintegrates with freezing and thawing. Everything possible should be done to keep water out.

Placing

Vibrated concrete, when properly controlled, is superior to hand placed concrete. Vibration permits the use of stiffer mixes, which have less water and less tendency to segregate. It results in less honeycombing and fewer porous spots. If the mix is kept sufficiently stiff, the danger of over-vibrating is slight. The danger comes from vibrating too wet a mix, in which case serious segregation will occur.

Concrete should be placed in the forms as near as possible to its final position. Shoving it toward the ends of the form should not be permitted. Most of our poor concrete is at the ends of wings and at construction joints, where the concrete has been shoved some distance, causing segregation and water gain. Chuting into place is conducive to segregation and should not be permitted.

Aggregates should be proportioned by weight. It is hoped that automatic recording instruments will soon be available for both small and large jobs, so the man in the field can see at a glance the different weights of all materials that have entered every batch. A method of instantly obtaining the moisture content of sand would be a godsend to the concrete inspector, and would insure a more uniform and economical mix.

Concrete to resist sea water or alkali must be dense and impermeable, preferably employing sulfate-resisting cement. The reinforcement should have at least 2½ in. coverage, and the surfaces of the concrete should be waterproofed with acid-resisting waterproofing.

Mixing water should be clear, fresh (not salt) and free of organic matter, acids, alkalis or other deleterious substances. In general, water fit for drinking purposes will be satisfactory for mixing, except in alkali-water districts, where all water should be tested.

Poor concrete is more liable to be at the top of pours, where the water and laitance collects. Concrete can be brought to the top of the form and allowed to set a short time, after which the top few inches can be removed and wasted, being replaced with fresh concrete. Or the concrete can be brought to within 12 to 18 in. of the top, then allowed to set a short time, after which the form should be filled with a drier mix.

Other Considerations

Concrete will settle away from structural steel members or reinforcing steel anchored near the top of high pours, causing voids which will later collect damaging water. The only suggested remedy is to pour to the underside of the steel and allow the concrete to set enough to eliminate at least some of the settlement. For this reason, round horizontal reinforcing is preferable to square bars.

Expansion joints in retaining walls should be spaced 20 to 30 ft. apart, preferably constructed so each section stands alone. Reinforcing steel across a construction joint is not desirable, and a vertical keyway tends to collect water which may develop a head, in addition to reducing the concrete section at that point. It would seem good practice to drain the bottoms of construction joints.

Expansion joints in pavements at 100-ft. centers, with dummy joints 1¼ in. deep on 20-ft. centers, is good construction.

One railroad obtains good wearing floors and pavements by using trap rock or other tough stone for a topping. The concrete is mixed with not more than 3½ gal. of water per bag, which requires the use of a mechanical float. The surface is then troweled and later roughened with fine bristle brushes. If exposed to the weather, air-entrained cement is used. Adequate water curing is insisted upon. Heavy-duty floors can be constructed in two courses, with a top finish ¾ in. to 1 in. thick, containing tough pea gravel or other small size durable aggregate graded from ⅜ in. to ⅝ in., applied to the base slab before it has taken its initial set. This should be placed as stiff as possible, with a 1:1:1½ or 2 mix, using a power float. A mortar topping should not be used for heavy-duty floors or bearings under heavy load. Several railroads use iron troweled into the finish coat for inside floors, with favorable results, except for some discoloration.

We are well aware that this report omits entirely many important questions concerning concrete and barely mentions some in which you are intensely interested. The subject is much too broad to cover in one report. The best we can expect is that this will serve as a stepping stone to further work on this subject.

Conclusion

To improve the strength, durability and wear resistance of concrete exposed to the elements, design for strength in accordance with the water-cement ratio and use as small an amount of sand and cement as possible to obtain the desired workability. Use well-graded, durable, non-absorbing, non-laminated coarse aggregate, with durable sand having sufficient fines. Use low-alkali cement unless positive your aggregates are non-reactive with alkali. Provide adequate drainage. Waterproof the back sides of all walls in contact with earth, and waterproof all exposed flat surfaces. Prevent all trapping of water. Weigh the aggregates. Provide adequate curing. Use air-entrainment if subject to freezing and thawing and, above all, provide adequate skilled supervision.

Bibliography

Expansion of Concrete Through Reaction Between Cement and Aggregates, by T. E. Stanton, A. S. C. E. 1942 Proceedings.

Research on Concrete Disintegration, by H. S. Mattimore and G. H. Rahm, Jr., Proceedings A. S. T. M. Vol. 35, 1935.

Concrete Deterioration at Parker Dam, by R. F. Banks, Engineering News-Record, March 27, 1941.

Approach to Design Concrete Aggregates, and Aggregate Selection and Control, by C. E. Wuerpel, Civil Engineering, August and September, 1939.

Entrained Air in Concrete, A Symposium, Journal-American Concrete Institute—June, 1946.

A Study of Chert as a Deleterious Constituent in Aggregates, by H. S. Sweet and K. B. Woods, Engineering Experiment Station—Purdue University.

Committee Personnel

J. S. Hancock (chairman), br. engr., D. T. & I., Dearborn, Mich.; A. B. Chapman (vice-chairman), engr. & supt. br. & bldgs., C. M. St. P. & P., Chicago; R. W. Gilmore (vice-chairman), gen. br. insp., B. & O., Cincinnati, Ohio; Franz M. Misch (vice-chairman), gen. b. & b. supvr., S. P., San Francisco, Cal.; J. R. Burkey, consult. engr., Union Metal Mfg. Co., Columbus, Ohio; J. E. Carroll, mgr., constr. equip. div., Harrow, Rickard, McCone, Los Angeles, Cal.; H. A. Gerst, asst. engr., G. N., St. Paul, Minn.; W. L. Luce, mast. carp., Erie, Huntington, Ind.; Chas. R. Lyon, dist. mgr., Master Builders Co., Chicago; W. H. Lytle, supvr., b. & b., N. Y. C., Anderson, Ind.; I. A. Moore, trmstr., C. & E. I., Salem, Ill.; W. V. Parker, research engr., U. S. P. H. Ser., Memphis, Tenn.; O. M. Saxton, Chicago mgr., Timber Structures, Inc., Chicago; G. L. Sitton, asst. ch. engr., Sou. Sys., Washington, D. C., and G. F. Stull, b. & b. fore., K. C. S., Shreveport, La.

B. & B. SECTION

Developments in the Use of Off-Track Equipment

Report of Committee

F. R. Spofford
Chairman

A YEAR ago we were all animated with enthusiasm by the successful termination of the struggle in which we and our allies had been engaged for the last four years. It seemed that the period ahead would be much more productive of permanent improvements in our properties and facilities than had been possible during the war years.

Unfortunately, this was not to be. Progress has, of course, been made, and extensive renewals and improvements have been completed. The difficulties that have faced us, however, have been as great or greater than those during the war years. Materials in many cases have been even more difficult to obtain. Restrictions on general building construction, for the avowed purpose of providing homes for veterans, has produced utter confusion. If these restrictions had accomplished their purpose, we would have no quarrel with their protagonists. It is painfully apparent, however, that they have not and will not accomplish that purpose.

Labor troubles and strikes have contributed their full share to the chaos of material supply. In the case of many materials, it is impossible to obtain commitments as to delivery dates. In many instances a delivery date means simply a date to start following up the order, with no real indication of when the material will be received.

The situation with respect to work equipment, at least in so far as actual deliveries are concerned, is in many instances worse than that of general construction material. The manufacturers have done and are doing everything in their power, but are dependent on suppliers who are, in turn, dependent on the whims of irresponsible labor leaders.

Much Unproductive Labor

During the last year, we in the bridge and building department, together with those in other departments of the railroad, have experienced labor troubles. A large increase in direct wages has increased the cost of doing our work. Recent legislation as to pensions and unemployment compensation will increase the indirect labor charges considerably.

These increases in labor costs point to the necessity of so planning our work that the labor costs under our control are kept to the absolute minimum, and still permit the accomplishment of the results desired by our managements.

The labor costs under our control consist of two general parts. One of these includes the cost of labor actually engaged in productive work on any project. To keep this at the minimum requires that we make, so far as possible, each man the operator of a machine or tool. The day of a strong back and a weak brain in B.&B. crews is gone.

The second part of our labor costs is the non-productive labor charges for operating crews for the protection of our work equipment when on the track. So long as track-mounted work equipment is used, this will be encountered. The labor organizations representing these men are powerful and grasping. Pressure is increasing to require operating crews on all equipment operated on the track. In many cases this has already resulted in increases in the number of men required beyond the needs of safety for the operation of trains. For example, on many railroads, a locomotive fireman or engineer is required on each locomotive crane, in addition to the crane operator. This provides an extra job for no work performed.

The only way this unnecessary overhead expense can be avoided is to get our equipment off the rails and keep it off. This has the important additional advantage of minimizing delays to trains.

Great care and careful planning are required to insure that off-track work equipment is used in such a manner as to avoid the possibility of claims from operating employees that they be allowed to furnish protection for the passage of trains. It is true that, in many cases, this cannot be avoided, but careful planning and forethought can keep such demands to the irreducible minimum.

Highway Motor Equipment

The cornerstone upon which our structure of off-track construction and maintenance must be built is the highway motor truck. The development in trucks for war use was no less than phenomenal, and we should reap the benefits in the next few years.

Before the war, for all practical purposes, the highway motor truck was confined to a hard-surface road. With the more complete development of four-wheel drives, the mobility of trucks is practically unlimited. With the exception of deep mud or thick forests, modern heavy-duty trucks can go almost anywhere. Even these obstacles can be overcome by cutting roadways through forest growths and by corduroying swampy ground.

For a large job, even a considerable investment in providing a temporary road will be more than offset by the savings in work-train expense and reduced delays to trains and interruptions to the work. By suitable negotiations with land-owners, permission to build such temporary roads can generally be obtained, as in most cases they enhance the value of the land to the owner. With modern bulldozers, equipped with rooters, etc., and other suitable earth-moving equipment, the expense of such temporary roads is not excessive.

With an access road available for the use of motor trucks, there are a number of methods of conveying equipment to the job. The choice depends largely on the size and weight of the equipment.

Small and light equipment can be carried in the trucks, or towed behind them, if equipped with pneumatic tires. Medium-size equipment can be moved on a trailer, pulled by a general-purpose truck. An interesting development in trailers for this purpose is a two-wheel trailer, which is made self-loading by the long end of the body forming a ramp, which is later lifted for attachment to the truck; the equipment being balanced over the axle.

The heavier units of work equipment can be handled on special low-body trailers pulled by truck tractors. Such hauling equipment will not ordinarily be owned by the railroads, but can be rented as required from concerns specializing in the transportation of heavy equipment.

On the job itself, hand labor should be kept to the minimum by the use of power tools. Developments in these tools have been many and of great interest. They are, however, outside the scope of this report. On the other hand, the source of power for operating such tools does fall within the scope of this report.

Power Supply for Tools

Until a few years ago, and even at present to the extent that it has not been replaced by more suitable equipment, the conventional source of power for the operation of power tools was a compressor, either track mounted or skid mounted. In any case, the compressor was set off at one location and, ordinarily, was not moved during the progress of the work. If the job was large, with any sizeable number of air tools in operation, the compressor was large and heavy, and the cost of getting it to and from the job was excessive.

At present, even large compressors can be had mounted on pneumatic tires, and can be readily towed to the job. However, the most pronounced and beneficial development in power units is the trend toward small, readily-movable units. In most cases, experience has shown that it is better and more economical to have several small power units placed where needed. Where this practice is followed, the failure of a single unit does not cripple the job until it can be replaced or repaired. Where a single large unit is employed, failure could completely tie up the job. An even greater advantage in the use of several small units is the elimination of the long pipe lines frequently necessary in the past where single large units have been used. The small units can be placed where needed, and moved from time to time as required.

The power units now in use include both air compressors and electric generators of many types and makes. All have been modified and improved extensively during the war years to meet the need of the construction forces of the army and navy.

Due to the types of specially adapted tools available for use with them, air compressors are essential on jobs involving the drilling or breaking of masonry, the driving of rivets, and general steel erection and repairs. They are equally satisfactory for general work and for timber fabrication and erection. Preferably, several small units should be used, with the largest capable of providing ample air for such heavy-demand tools as rivet busters or large rock drills.

For working in timber, electric tools have some advantages, among which are their light weight, and the greater ease of handling an extension cord than an air hose. Since on many jobs it is necessary to progress work at night to avoid interference with trains, generators may be necessary in any event for providing illumination.

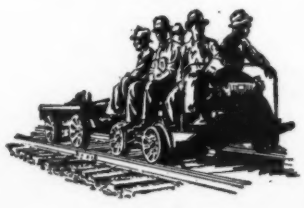
For small jobs requiring few tools, the generator may be light enough to be carried by one man. The most generally useful unit, however, is one of medium weight which can be carried by a few men or wheeled on rubber tires. This is the same type unit used by track forces to operate tie tampers. If used by the track forces, the adoption of this type by the B.&B. forces has the advantage of reducing the number of repair parts to be stocked. Generators larger than this should, ordinarily, not be considered, as their reduced mobility is objectionable.

Beyond the power supplies for the operation of tools on the job, the greatest field for work equipment in bridge and building work is in the handling of materials. In the past, many jobs requiring the handling of heavy materials have been done by brute strength alone because the job as a whole did not warrant the expense of work-train service to provide cranes or hoists.

Hoists and Cranes

There are now available a number of types of power hoists which make this expensive use of manual labor archaic. Perhaps the most generally useful of these is an air hoist operated by a portable compressor. With such a hoist and gin poles and suitable rigging, heavy timbers can be placed in overhead or track bridges, piles can be cut off and spliced, timber bents renewed, repair steel erected, and many other types of work performed with little hand lifting. Similar electric hoists are available and several types of trucks have hoists operated by power take-offs. For making renewals of individual members of a structure, careful consideration should be given to the use of one or more of these types of hoists before considering more elaborate hoisting equipment.

Before the development of modern heavy-duty, track-mounted locomotive cranes and derrick cars, a large amount of railroad construction was performed by the use of guy derricks. These were operated by steam engines requiring in each case a cumbersome boiler and an adequate water supply. With modern gasoline hoisting engines now available and the considerable development that has taken place in these guy derricks, it would seem that, in some instances at least, these would be of value. We mention this in passing as a line of investigation for individual members, particularly in light of the fact that one large bridge has been erected recently by such equipment.



The most generally useful device for lifting material where the weight is not too great is the highway motor-truck crane. This has seen great development during the last few years. Such cranes can be obtained in many types. Heavy-duty cranes of this type can be had with long booms and capable of handling heavy loads. Their value is greatly enhanced by their extreme mobility. Such a crane need be brought to the job only for the period that heavy lifts are to be made. At other times it can be moved readily to other jobs or used for other types of work.

A variation of the highway motor-truck crane is the wheeled tractor crane. This has been developed primarily for the handling of freight or cargo at freight terminals and yards, or on piers and wharves. However, where a railroad has such cranes, they can be used to advantage on many construction jobs. Such tractor cranes, developed during the war, are of greater capacity and usefulness than those available only a few years ago.

For heavier lifts, or for jobs where cranes will be used for a considerable period, crawler-type cranes are generally more suitable than truck cranes. Modern types of crawler cranes move much more rapidly than those built a few years ago. They can be used on rough ground and under other conditions where a truck crane is not suitable. By placing planks on the ties of open-deck bridges, outside the running rails, they can be used readily on the decks of such bridges. Furthermore, they can be moved off such bridges, and off the tracks in the clear for the passage of trains, in less time than a track-mounted crane in a work train, unless a special construction track has been built for it at the site. In most cases it will cost less to obtain access to the job for off-track equipment than to build such a construction track.

Off-track cranes can do most of the work expected from track-mounted cranes, and even much that can be done by track-mounted pile drivers. It is true that for some railroads having large numbers of long pile trestles, the possession of a special pile-driving rig is still essential. However, for the smaller pile bridges making up the vast majority of those we deal with, a crawler crane equipped with swinging leads is a much more productive investment.

Power for the pile driving hammer is ordinarily furnished by a portable steam boiler. Piles can be driven successfully by compressed air if sufficient compressor capacity is assured, and preferably if the air is manifolded into a large air reservoir to reduce the drop in pressure when the hammer is working. In cool or damp weather, the use of alcohol in the air line is advisable to avoid the formation of ice in the hammer.

A further factor to be considered in

the use of off-track equipment is the possible redesign of structures to reduce the necessity for interference with traffic. A notable example of the possibilities in this respect is seen in the work of one road which recently replaced an important timber pile structure, using fluted steel piles, driven in sections from beneath the deck with off-track equipment. The only interference with traffic during this job was during the actual installation of the new deck.

A variation of the crawler-type crane is the crawler tractor equipped with boom and hoist, developed only during the last few years. A major use of this type equipment has been in the construction of cross-country oil and gas pipe lines. In addition to its use on pipe-laying jobs on the railroads, this type equipment should prove of value for a wide range of miscellaneous construction.

Track-Walking Shoes

An interesting development in connection with crawler tractors is that of track-walking shoes, which can be applied to any tractor of proper size to permit it to travel on the rails. While this development is of primary interest to the track supervisors, a tractor with boom and hoist, equipped with such track-walking shoes, may well be the answer to the problem of providing off-track hoisting equipment at many points difficult of access from highways.

When we turn to B.&B. activities other than the repair and construction of bridges, it is apparent that off-track equipment is the only thing to consider. These other activities lie almost entirely within the scope of the general construction industry, for which most off-track equipment has been specifically developed. The same equipment which we consider desirable for bridge work—namely, light, portable compressors and generators, truck cranes and crawler cranes—is likewise best suited for our general work.

Modern highway truck cranes and crawler cranes are equipped with accessories to operate as power shovels, ditch hoes, bucket excavators, etc., as well as hoisting units. Such equipment is ordinarily of greater interest to the track forces, but properly selected, such equipment can satisfactorily meet the needs of the bridge and building department as well.

It is apparent from the newer types of equipment being produced that much greater thought is going into its design. This is the basic essential in any off-track machine. If we choose a correctly designed machine and maintain it properly, we can get back our investment. Therefore, it is our feeling that the most careful thought should be applied to the choice of the design to be adopted. We should, so far as possible, avoid the choice of a design which has limited use. A good design with proper appliances, which will meet most nearly the needs of all concerned over a period of years, is the best investment.

In the final analysis, the effective use of off-track equipment is just one part of the general endeavor of all railroad employees—to move the most passengers and the most freight with the least expenditure. To attain this goal, all phases of our efforts must be properly balanced. The design of structures must be adequate but not excessive, and must be adapted to those methods of construction and repair that will prove most effective in the final accomplishment of our purpose.

Committee Personnel

F. R. Spofford (chairman), asst. div. engr., B. & M., Dover, N.H.; W. F. Martens (vice-chairman), gen. fore. b. & b. and w.s., A. T. & S. F., San Bernardino, Cal.; C. E. Russell (vice-chairman), supvr. w. s., I. C., Chicago; John D. Trulove (vice-chairman), gen. b. & b. fore., S. P., Sparks, Nev.; H. F. Bird, supvr. b. & b., N. Y. C., Syracuse, N.Y.; J. R. Burkey, consult. engr., Union Metal Mfg. Co., Columbus, Ohio; M. D. Carothers, ch. engr., Alton, Chicago; C. M. Colvin, dist. supt., cons. div., Armco Dr. & Metal Pr., Berkeley, Cal.; R. E. Dove, *R. E. & M. Cyclopedia*, Chicago; Paul Haines, asst. b. & b. supvr., P. M., Saginaw, Mich.; V. W. Hutchings, b. & b. supvr., S. P., Bakersfield, Cal., and E. E. R. Tratman, civil engr. (retired), Wheaton, Ill.

B. & B. SECTION

Utility and Economy of Prefabricated Buildings

Report of Committee

A. G. Dorland
Chairman

THE subject of prefabricated buildings covers any type of building formed of sections or panels of floor, wall, ceiling and roof units, which can be assembled and erected in the field more rapidly and with less labor than conventional buildings constructed entirely on the site. It also embraces entire buildings which can be moved from one location to another without dismantling.

Probably the first portable buildings to be used by the railways were box car bodies or portions of box cars. These have been used to house employees and for offices, tool houses, etc., and all bridge and building men are familiar with their advantages and disadvantages.

Concrete Buildings

One well-known company now has on the market a precast concrete building, available in different sizes with the following inside plan dimensions: 6 ft. by 6 ft.; 6 ft. by 9 ft.; and 8 ft. by 10 ft. These buildings are complete with door, window and roof ventilator, and can be used to house equipment or materials at outlying locations or as watchman buildings. They are attractive in appearance, are fireproof, and will not be damaged by wind or inclement weather. In addition, there is little chance of their being damaged by vandalism. They can be equipped with racks or bins and valuable electrical or signal apparatus, or oil, gasoline, fusees, etc., can be safely stored in them.

No foundation is required for these buildings, except in some locations where unusually soft ground is encountered; no painting is necessary, except for the door and the window frames, and they can be moved in their entirety from one location to another. However, their weight is from 11,000 lb. to 19,000 lb., which, in most cases, requires that a crane be used to load and unload them.

The prefabrication at the mill or shop of some parts of buildings, such as window sash, doors and their frames, cupboards, racks and closets, has been standard practice for many years. A little later we began to use wallboard and roof slabs, and in some cases roof trusses. It is only within recent years, however, that there has been mass production of prefabricated buildings which can be readily erected at one location and, after serving their purpose in that location, can be taken apart and reassembled rapidly at a reasonable cost in another location. This industry producing such buildings is still in its infancy, but may grow to be a good-size child, and probably to full manhood, as

numerous companies are organized in all parts of the country to produce prefabricated buildings.

These manufacturers furnish prefabricated sections to form the floor, roof, enclosing walls and interior partitions, complete with bolts, etc., but it is necessary for the railroad to erect the structure. Most of the companies in this business to date are specializing in prefabricated houses, and leave it to the erector to install the foundation, chimneys, plumbing, drainage, and electric wiring and fixtures. Some producers of prefabricated houses furnish the plumbing and the kitchen and bathroom units, which reduces materially the amount of work in the field.

Prefabricated Dwellings for Extra Gang Laborers on an Eastern Road

Steel Buildings

Some prefabricated buildings of steel are erected with comparatively light structural steel frames and roof trusses, and are covered with steel sheets in proper shapes to fit. In some cases these have panels lined with insulating board, which makes them more comfortable and adds to the appearance of the interior. This type has been used for many years for tool sheds, motor car houses, garages and similar structures.

One manufacturer has been furnishing prefabricated steel buildings for more than 25 years. This company will design and furnish the material for a building of almost any size. One eastern railroad has a warehouse furnished by this manufacturer, 160 ft. by 1,300 ft., and the same road has prefabricated buildings as small as four feet in width. The same manufacturer has furnished material for locomotive shops, car repair shops, etc.

Another type of steel building is the steel-panel type, which is formed of shop-fabricated galvanized sheets having interlocking flanges. The panels are self-supporting and load bearing, the structural strength being obtained by the folded interlocking flanges of the individual steel sheets. Field assembly is accomplished by fitting the panels together and securing them to the foundation. The panels are formed from 18 to 22-gage metal in 16-in. widths, and of various depths to suit the structural requirements of the building in which they are to be used. For floors and flat roofs having longer spans, the panels are made narrower and of 12 gage material. All bolts, screws and other fastenings are of galvanized or cadmium-plated steel.

The buildings are erected upon a base angle secured to a concrete foundation by anchor bolts. Between the foundation and the base angle an asphalt-felt strip is inserted, which serves as a cushion and moisture barrier. The exterior wall panels are erected with the face cut to form the exterior surface. Wood furring strips are fastened to the inner projecting flanges and serve as a nailing base for the application of the interior wall surfacing. Lath and plaster, plywood, or various kinds of wallboard may be applied. When insulation is desired, rock wool batts may be applied between the wall surfaces.

Pitched roofs are constructed of panels erected with the flanges upstanding, forming tight, self-flashing ribs. The roof panels are painted and require no further waterproofing. The roofs may be either flat or pitched. Floors may be of concrete or of wood panels carrying a wood sub-floor and a finished floor of wood or other material.

The finishing of a steel building and the installation of the mechanical and electrical equipment are carried out in practically the same manner as for a building of conventional construction. The size of these panel-type buildings ranges from 8 to 24 ft. in width, with variable lengths. The surface permits painting immediately after erection, if desired.

One railroad has a colony of nine of these buildings each about 10 ft. by 20 ft., to house construction laborers. This colony includes bunk houses, a kitchen, and a recreation and bath house. The railway prepared the concrete foundations and the buildings were erected under contract, thus benefiting by the use of experienced workmen. These small buildings, in 1945, cost approximately $325 each, plus about $150 additional for erecting them.

The company that furnished these buildings makes steel buildings of various sizes. One size, 8 ft. by 8 ft., and 8 ft. high, cost $120 in July, 1946. Another size, 12 ft. by 20 ft., with 8-ft. sidewalls, cost $270. A building 24 ft. by 40 ft., with 10-ft. sidewalls, cost about $850. These prices all f.o.b. Chicago, did not include doors, windows and ventilators. Ventilator-type windows cost approximately $15 and doors vary from $25 to $100 each, depending upon type and size.

One company makes a "mastic-protected metal" roofing and siding, in either corrugated or flat sheets. The mastic replaces galvanizing and rolled methods of bitumen application. The clean uncoated sheets or prefabricated shapes are dipped in a mastic preparation, after which a mineral coating is applied to protect the surface. Thus, the finished surface does not require painting and is virtually free from any maintenance costs.

Redwood Siding

One manufacturer of frame buildings uses clear, all-heart California redwood T. & G. siding. The panels for the side walls are obtained in 8-ft. sections. The standard width of these buildings is 20 ft., but the length may be varied in multiples of 8-ft. One eastern railroad has erected 35 of these buildings, all 20 ft. wide, but in lengths of 16 ft., 40 ft., 56 ft., 72 ft., 88 ft., and 256 ft.

The wall panels are 3⅝ in. thick, of flush construction, and are so designed that part of the roof load is taken through the vertical siding. The windows and doors are an integral part of some panels, requiring no field fitting or setting.

The framing of the side walls and flooring consists of 2-in. by 4-in. and 1-in. by 6-in. or 1-in. by 8-in. lumber, respectively, of Southern pine, spruce, fir or hemlock, No. 2 grade or better. The ceiling joists are 2-in. by 6-in. pieces on 24-in. centers. Where floor insulation is desired, double floors, with 3-in. batt insulation built into the floor panels, can be had.

Usually, buildings of this type are placed on a pile-butt foundation. However, concrete slabs are sometimes substituted when a more permanent type structure is desired. After the buildings are erected, they are painted with the railway's standard color. Toilet and electrical fixtures are provided when desired.

Buildings of this type have been used as living quarters for imported labor. They are also being used successfully to house section foremen and their families. In several instances they are used to store chemicals in connection with water-treating stations.

One manufacturer of prefabricated plywood buildings has provided several railroads in the East with material for bunk houses, kitchens, dining halls, recreation halls, tool houses and warehouses. The basic unit of these structures is either 16 ft. or 20 ft. wide, and 8 ft. long, and any number of these units can be put together,

with cross partitions between them, as desired.

These buildings are made with weatherproof plywood walls over a rigid frame; are delivered knocked down, ready for quick and easy erection on piers or block foundations; and are completely demountable for removal to another site. All floor, sidewall, end wall and roof sections are interchangeable. This permits them to be used again in new combinations, in varying lengths to suit conditions.

One company manufactures barrack-type units of both plywood and wallboard construction, and has furnished many of the southern railroads with buildings in 20-ft. widths. Its price list in 1945 lists a 20-ft. by 20-ft. plywood building at $635; a 20-ft. by 100-ft. plywood building at $2,435; a 20-ft. by 20-ft. wallboard building at $670; and a 20-ft. by 100-ft. wallboard building at $2,545. This company also sells foundation blocks.

Railroad Has Own Design

One western railroad reports that it has used many prefabricated buildings, built to its own design. These buildings are built of units of such size that they can be easily handled by two men, and with units interchangeable; that is, all floor sections are similar, as are side-wall, end-wall and roof sections. Of this design, the buildings are limited in width, but they can be built to any length in multiples of six feet. They are sheathed with waterproof plywood, insulated on the inside with fibreboard.

End-wall sections are equipped with doors, and side-wall sections with windows. The various sections have been constructed on jigs near the source of lumber supply, and have been shipped bundled, as required, for a complete building. All sections are fastened together with bolts, making assembly and dismantling easy. These buildings were constructed at a cost far below the cost of similar structures built separately.

The same railroad has used similarly constructed buildings built and assembled at a central point. These buildings, which are used as labor houses, tool houses, dispatchers' offices, storehouses, etc., are 9 ft. by 32 ft., and are constructed on skids so they can be skidded onto a flat car, or they are lifted with a locomotive crane.

Some railroads are prefabricating buildings in their own shops, as their shop labor is about 35 per cent lower in cost than their field labor.

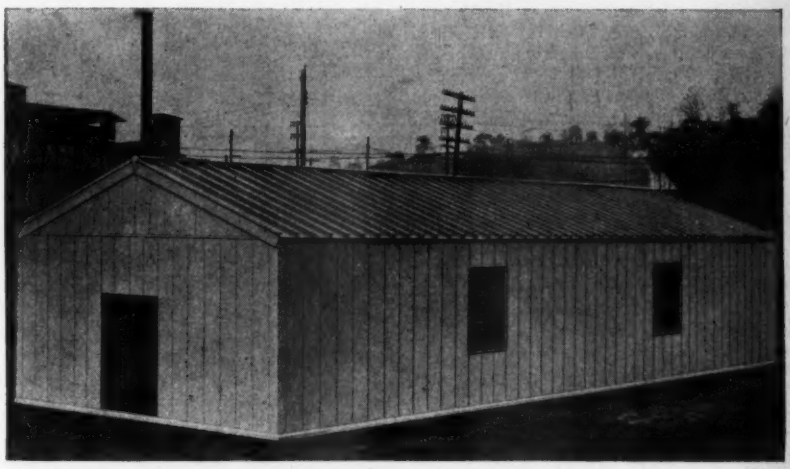
Some manufacturers have developed their assemblies for two-story structures, with limited floor loadings. Such buildings should be discouraged for railroad use because, after construction, they may be used for a purpose entirely different from that intended originally, and excessive floor loadings may cause collapse.

Some railroads have used automobile trailers to some extent, not only to house laborers, but also for foreman offices. In some cases employees use their own trailers to live in. However, the committee has not been able to procure enough data on the use of trailers to make report on them at this time.

The main advantage of prefabricated buildings for railway use are that they can be constructed much more rapidly than buildings of conventional design, and that they can be dismantled and reassembled in different locations if circumstances should require. In many cases also, prefabricated buildings can be erected at a lower cost.

Prefabricated frame buildings are light in weight, are easily handled and quickly erected. They are comparatively low in initial cost and can be erected at a relatively low labor cost. Their unit construction and unrestricted length afford flexibility to suit a considerable range of railway needs. For these particular purposes they have proven satisfactory.

The steel buildings are reasonably light in weight and afford a marked advantage in ease and rapidity of erection. They are of water-tight construction and are resistant to the attacks of termites and rodents. Since they are of steel, they command a lower fire insurance rate, Most manufacturers use a metal with a special surface treatment, so that immediate painting is permitted in any color desired. Also, this metal is supposedly rust resistant, so that painting can be postponed. It is believed that the ultimate cost of the steel buildings on an annual basis will be less than that for similar buildings of frame construction, since the steel buildings will require less maintenance. Although both the frame and metal buildings are demountable, it is believed that the steel buildings have the advantage that they are practically 100 per cent salvageable for use in another location.



Example of a Prefabricated Steel Building

Disadvantages—Limitations

There are also some disadvantages to the use of prefabricated buildings. The primary objection to such buildings of more than one story has been stated previously. In some localities, prefabricated buildings will not harmonize with the existing buildings and surroundings.

In many instances, city, town and village codes and ordinances do not permit the erection of prefabricated buildings, as the construction and materials do not comply with the code or ordinance requirements. It should be remembered also that frame structures are prohibited within the fire limits in practically all communities where building codes have been adopted. Both the steel and frame buildings generally have the added handicap of not complying with codes insofar as the thickness of framing members is concerned. It is important, therefore, to be sure that any buildings purchased meet with the minimum fire-hazard and safety requirements of existing building codes where they are to be used.

Each building problem should be studied individually before prefabricated construction is started. The use to which any building is to be put is most important. Occupancies introducing heavy loadings and rough operations may call for extraordinary maintenance and repair, entailing expenditures which, coupled with the initial cost, will far exceed the cost of a more permanent type of structure.

Committee Personnel

A. G. Dorland (chairman) asst. engr., E. J. & E., Joliet, Ill.; W. A. Huckstep (vice-chairman), gen. br. supvr., M. P., St. Louis, Mo.; L. E. Peyser (vice-chairman), prin. asst. arch., S. P.; San Francisco, Cal.; W. H. Bunge, asst. engr., M. P., Houston, Tex.; H. M. Church, gen. supvr. b. & b., C. & O., Richmond, Va.; Fred M. Lehrman, design. engr., Reynolds Metals Co., Chicago; L. C. Winkelhaus, arch. engr., C. & N. W., Chicago; C. F. Womeldorf, div. engr. (retired), C. & N. W., Norfolk, Neb.; W. A. Sweet, gen. fore. b. & b., A. T. & S. F., Newton, Kan.

Discussion

In answer to a question raised by F. G. Campbell (E.J.&E.), H. M. Church (C.& O.) stated that the employee organizations

B. & B. SECTION

representing building construction and maintenance men do not object to the railroads' use of prefabricated buildings because there is more building work to be done on railways than the employees can do, and the erection of the prefabricated buildings is carried out by railroad forces.

W. A. Huckstep (M.P.) pointed out that the use of prefabricated buildings was especially attractive at this time when, because of priorities in favor of war veterans, it was impossible in some cases to procure the necessary materials for conventional buildings.

L. E. Peyser (S.P.) stated that his road has used many prefabricated structures for housing Mexican laborers and for tool houses and telephone booths. He pointed out, however, that this type of building generally has a limited service life. When F. W. Hutcheson (C.&O.) declared that prefabricated buildings of steel will withstand more dismantling and moving than those of wood, Mr. Peyser stated that his road uses bolts and not nails in erecting prefabricated wood buildings as a means of preventing damage to the parts.

Cause and Prevention of Injuries to Bridge and Building Employees

Report of Committee

H. D. Curie
Chairman

SAFETY conditions would be improved and casualty rates correspondingly lowered if men would observe rigidly the old axiom concerning wild animals which goes as follows—"Self preservation is the first law of nature."

Man is not inherently safety minded; he must be taught safety to understand it and to put it into practice. Nearly all of his actions are ruled by habit and, although he may seek perfection in improving his habits, if encouraged and guided, he still may never become infallible. To accuse an employee of being unsafe before he understands what he is being charged with will naturally cause him to become resentful, and then his co-operation in the promotion of safety cannot be expected.

Great strides have been made during the last quarter century in the promotion of safety. There are two basic obstacles to be overcome in the elimination of injuries:

(1) Environment, unsafe tools, etc.
(2) Man failure

The elimination of unsafe, defective and obsolete tools, together with other safety hazards, has been well carried out. Nearly all accidents due to these causes are the result of man failures. Generally speaking, management no longer tolerates these conditions. When supervision and employees can reduce man failures to the extent that management has reduced hazards, then safety will have become a reality.

Many Hazards

Bridge and building employees are exposed to the dangers of personal injuries, more perhaps than any other class of railroad workmen. Their work entails exposure to a constant variation in hazards with each new day, Each job presents its own difficulties, even though it may be similar to another done previously, but in a different location. Most bridge and building employees have a constantly changing scene of action. A bridge gang may be repairing an enginehouse roof one day, and off to a pile-driving job the next. It may be repairing a trestle across a small ravine today, and tomorrow working at dizzy heights on a bridge over a rushing torrent. Under conditions such as these, the B & B employee must be on the alert at all times. He must be able to adjust himself to great differences in working conditions.

Common Causes

The more frequent causes of personal injuries are as follows: Inattentiveness, resulting in falls; being struck by moving objects, etc.; motor car accidents, such as collisions with trains, vehicles, other motor cars and animals; tools and materials falling off cars, causing derailments; fires due to broken or leaky gas lines; excessive speed; failure to observe obstructions on tracks and the flangeways of crossings; open derails and switches; improper drawbar connections; collisions due to operation in fog, snow or darkness; use of defective tools, scaffolds and equipment; wrenches or bars slipping; and the improper handling of power tools and machines. Injuries resulting from the improper handling of material are numerous. Foot injuries in this class can be reduced materially by suggesting to employees that they wear safety shoes.

Occasionally, an accident results from an explosion or fire due to cleaning fluid, natural gas, paint mixer, etc.; an explosion of compressed air containers; explosions when heating tar or creosote oil; electrical shock, resulting from booms, hoists, cables, guy wires, tape lines or tools coming in contact with wires carrying electrical current; and improper grounding, faulty insulation and contact with the electrodes of welding sets.

Generally, all excavations of four feet or more in depth should be strutted, except where very stable material is being excavated. Unusual care must be exercised where alternating layers of material are encountered, such as clay and sand, gravel or cinder; also quicksand. In these instances, excavations must be thoroughly cribbed and should have sufficient struts, well braced vertically and horizontally.

Cranes and Pile Drivers

The use of locomotive or crawler cranes by inexperienced foremen and operators should not be allowed. Cranes should not be used for loads greater than their capacity at any given radius. In handling heavy loads, especially with a single line, there is a distinct advantage in lowering the load with the boom, instead of using the brake on the line drum. Outriggers or rail dogs should always be used in case of doubt when handling heavy loads with locomotive cranes. Cables, sheaves, drums, frictions and brakes must always be kept well maintained. One man, preferably the foreman, should be delegated to give signals for all moves. Constant vigilance should be maintained to prevent cranes being moved into the paths of trains, objects, etc., and to avoid swinging the boom too near wires carrying electrical current.

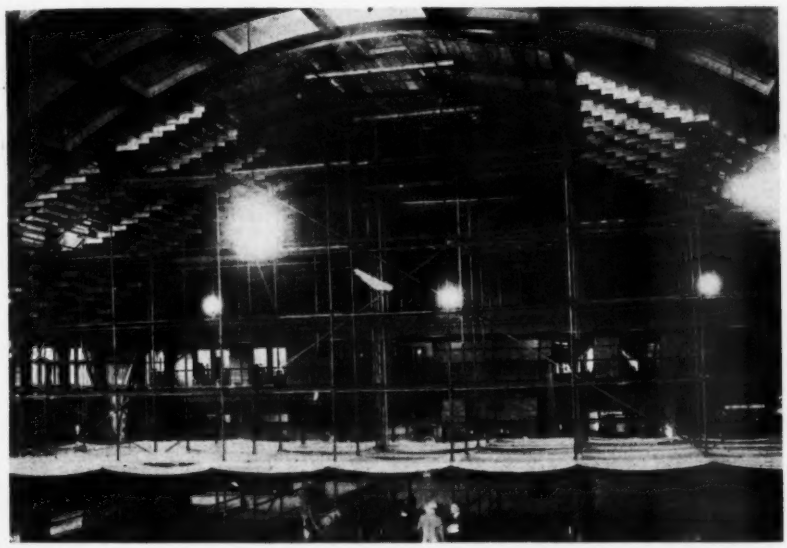
Pile drivers are the source of many personal injuries. A competent foreman, top man and operator, are essential to safe operation. One person should give all signals to the driver operator, and should always be in a position to be seen by the operator and foreman on the ground. All cables, leads, toggle blocks, etc., should be well maintained. In the case of steam hammers, particular attention should be given to the steam hose, as a broken steam hose or slipped connections can cause serious burns. Extreme care should be used in placing piling in leads, or in raising or lowering the hammer, so that the steam hose is not caught or pinched, causing failure.

Gin poles should be properly anchored and well guyed. The use of three or more

guy lines is desirable for extra heavy lifting. The type of guying must be determined by the character of the work being undertaken, as there are instances when more than two guys can not be used.

Explosives

The handling of explosives and combustible materials is generally well covered by the rules and regulations of nearly all railroads and the Interstate Commerce Commission. Placards on this subject should be posted in conspicuous places. All employees should be taught methods of safe handling of explosives and combustible materials, and handbooks and literature relating to this subject should be passed around among all employees. Carelessness should never be tolerated in the handling of explosives. Only capable, alert and conscientious employees should be assigned to handle them. Numerous accidents each year can be attributed to the improper handling of the gasoline used in the motor cars and machinery used by B & B gangs. Gasoline should be handled in approved type safety cans. Smoking and open-flame lights should be absolutely prohibited in the vicinity of gasoline. Repairs to gasoline tanks should be made only by experienced mechanics.



Scaffold in a Large Railroad Waiting Room

Fixed Scaffolds

Scaffolding of some type is used on practically all bridge and building jobs. Both steel and wood are commonly used for scaffolding of the suspended or built-up types. Both have advantages; steel scaffolds are preferable for jobs of long duration, particularly for work at higher elevations, and are not subject to fire hazards, have more resistance in high winds, and do not occupy as much space. Furthermore, they are easily removed without much damage. However, light tubular, sectional steel scaffolding is designed to carry given loads of men and materials, and because of this feature, its use may be restricted to a certain extent.

Lumber is carried on cars for many classes of maintenance work, and is usually available for scaffolding on all construction jobs. However, the material on hand is not always suitable. It may be second-hand, knotty, checked, and badly warped, or it may not be of the recommended soft pine woods. Because wood scaffolds are usually of a temporary nature, their importance to safety is sometimes neglected in the choice of materials, design or workmanship. This is false economy because it creates the possibility of accidents. Wood scaffolds should be built with specified materials, and should be provided with railings and solid toe boards, including wire mesh between toe boards and railings, as a precaution against tools and material falling off the platforms when working over streets, alleys and walks, or adjacent to windows and doors.

Scaffolds are usually designed to carry known loads, with a safety factor of 3, after allowances have been made for defects in materials. Adequate bracing against shock and wind are important. Soft woods are recommended, preferably straight-grained pine of the structural type. This is particularly true of platform plank, which should be at least 2 in. thick, and a minimum of 10 in. wide to reduce the tendency to overturn. When more than one width is used, platform plank should be cleated together on the bottom side. A sufficient number of platform plank, conforming to recommended sizes and quality, should be carried in stock and marked so they will not be used for any other purpose.

Swing Scaffolds

Swing scaffolds are used commonly for repair and paint jobs at high elevations, on such structures as water tanks, stacks, coaling stations, bridges and buildings. The use of such scaffolds involves a number of hazards not common with other types. For this reason, only employees who are thoroughly familiar with these hazards should erect or use them. Hangers may be of one-piece iron, passing underneath the platform, to which railings and toe boards are fastened. Some, however, prefer the heavier type, made up of framed timbers assembled with bolts and rods, with cable slings and rings at each end, to which tackle is fastened. Tail lines are used to guide or adjust scaffolds to position, and to prevent swinging.

The question of safe anchorage and block and tackle is equally important, and must be prescribed or approved for each particular job, mainly because the relative strength of various kinds of rope, cable, chains, metal hooks, rings and blocks is often assumed, and not always known. Safe anchorage is so important that more than one supervisory officer should check and agree on the location and part of the structure to which tackle is to be anchored, such as cornice, eaves, fire escapes, stacks, ventilators, railings.

Barricades and warning signs are an added precaution, and are often necessary to prevent the public, vehicular traffic, and cranes and other power equipment, from coming in contact with scaffolds and guy lines. Scaffolds erected adjacent to a track must conform with prescribed safe clearances, or be protected by close clearance signs, slow orders, slow signs and flagging, depending upon whether main track, siding or yard track, and the traffic involved.

Men working from scaffolds that are dangerously close to moving machinery, belting, gears, shafting, or to electric power lines, must have a definite understanding as to how the work will be accomplished safely if it is not possible to shut the power off during the period when work is under way.

B. & B. SECTION

Falls

Injuries sustained from falls are usually of the more serious type and, proportionately, are greater in number than any other class of accidents. Falls are usually due to one or more of the following causes:

(1) Overloading, defective materials, faulty design.
(2) Lack of railing or toe boards, or both.
(3) Falling objects, such as refuse, materials and tools.
(4) Failure of floor boards.
(5) Failure of tackle.
(6) Wind, fire.
(7) Carelessness.

Cutting and Welding

A number of precautions must be observed in cutting and welding. The use of a cutting and welding torch always presents the hazard of fire and burns. It should never be permitted around highly inflammable or combustible material.

When necessary to do this type of work where there is danger of fire, a suitable type of fire extinguisher should be at hand for immediate use. Also, where deposits of grease or oil are involved, a bucket of sand should be kept readily at hand. Operators must be extremely careful to avoid fire in their clothing, and burns on their bodies from splatter. The use of asbestos gloves for welding and cutting is recommended. Operators should be prohibited from the use of cutting or welding torches without prescribed goggles or shields. Employees in the vicinity of this type work should be cautioned against watching the operations without using dark glasses. The use of shields at regular welding or cutting benches is desirable. In shops where work of this character is done regularly, a bench with fire-brick top, along with a concrete or metal-covered floor, is advisable.

Other Precautions

In electric welding the arc flashes are very hazardous to all persons in the immediate vicinity. Shields should always be used where other persons are working. Serious eye injury or headaches are caused, even though a person does not look directly at the arc, as the flashes will penetrate from the side of the eye. Proper grounding, well-insulated electrode holders, and freedom from dampness, will eliminate numerous chances for accidents. Care must be exercised in the handling of electrode holders to prevent contact with the body.

The repair of oil, gas or naptha tanks, or of tanks or containers that hold or have held any inflammable material, should never be undertaken except under the supervision of a competent person who is thoroughly versed in the rules pertaining to this class of work. The tank or container should be thoroughly washed or steamed, aired and dried out before any welding is done, and no work should be undertaken without all vents and openings being clear, to allow the escape of vapor.

Air and Electric Tools

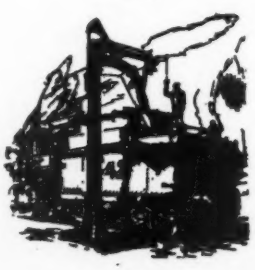
The use of air and electric tools is steadily increasing and constitutes additional hazards when not done properly. Only men who are mentally alert and physically fit should be assigned to operate these tools. Incompetent operators can cause injury to themselves and other nearby employees. Operators should be thoroughly instructed in the safe and proper handling of these tools. One important item to be stressed is: never become careless in the handling of power tools. The improper use of any tool may cause a defect not readily noticeable. Continued use may cause personal injuries.

Pneumatic tools and equipment are a source of numerous injury possibilities. If hoses are allowed to become damaged through carelessness, or are used after they have become too old to sustain pressure, an accident may result. We all realize the danger of a loose, flying air hose. The constant roar of the compressor and the racket set up by tools make it necessary for the workman to depend upon his eyes alone for safety when working near other equipment, such as derricks, pile drivers or power shovels. Workmen must be taught to be on the alert at all times. Electric tools and equipment, unless kept in first-class condition, are apt to cause personal injuries such as shock and burns, that can be fatal under certain circumstances. Proper maintenance and thorough instructions to operators mean fewer personal injuries.

Adequate Shields Should Be Used When Welding by the Electric Arc Method

Motor Car Accidents

There are thousands of track motor cars in operation every day. An appalling number of these cars are involved in accidents each year, which are resulting in numerous fatalities and serious injuries. This needless sacrifice of life and untold suffering occurs annually, and although for years new rules, new teachings, and improved methods of examination have been promulgated and put into effect, they have failed to stem the tide of motor car accidents in the same proportion as other types of injuries. With few exceptions, motor car accidents have been adjudged preventable. For the most part they have occurred because the person in charge of the car failed to use good judgment, either because he failed to observe the rules that govern, or because one or more employees were derelict in their responsibility and duty, even though not directly involved in the accident.



The responsibility for the safe operation of a motor car rests, obviously, on the motor car operator first, and on the foreman, if in charge. Safety engineers and railway officers, as a group, seldom fail to agree on who must bear the burden of responsibility. Who is responsible is thoroughly covered in the safety and operating rule books common to all railroads operating motor cars.

It is the consensus of railroad managements and operating and maintenance officers that motor car operators are responsible for the operation of their cars and the lives of all who ride with them. It follows, therefore, that the qualifications for this position must be of a very high order—much higher than have been set for many who operate cars today.

In the past few years there have been a number of very serious motor car accidents due to coupling bars becoming disengaged and dropping down and derailing a trailer car or truck car. There is evidence that insufficient attention is being directed to the use of a standard coupling bar with pins equipped with automatic positive locking devices. As bolts and nuts equipped with cotter keys are often hard to remove without tools, there is a tendency to use the bars without nuts or cotter keys on the pins. This practice eventually results in a serious accident.

Car Operation

Motor car operators must be made to realize that trains today operate at much higher speeds. They must be impressed with the necessity of security line-ups or orders for the operation of their cars whenever it is possible to do so. When there is any doubt as to the locations of trains, flag protection, torpedoes and fusees should be used. It is very desirable that there should be additional wayside telephones at or near obstructions to view. Consideration should be given to furnishing each motor car with a portable telephone where wire service is avail-

able. The general and successful use of radio communication in the last war would suggest the future possibility of radio-equipped motor cars.

The managements of some railroads have resorted to the use of automobiles and highway trucks by their track and bridge and building forces to reduce the hazards of personal injuries and train derailments caused by track motor car operation. Reports of these roads indicate a considerable reduction in man-hours and injuries by this practice.

Motor car operators should be examined at least every six months on safety, operating, and motor car rules by a qualified examiner. Supervisors should keep a constant check on individual operators to see that they do not become careless. They should also impress upon all others riding on motor cars the importance of being constantly on the alert, in the interest of self preservation and the welfare of other employees.

The actual responsibility for the teaching of safety to employees must, necessarily, rest with supervisors and foremen. They must start the new man on the right path with a system of teaching and education. They must watch over the older men to see that they do not violate the safety rules and teachings, and they must, at all times, exemplify their teachings on safety. Employees can not be expected to live up to the rules and teachings if their supervisory officers are constantly breaking safety rules.

Not all accidents are preventable. But when the time arrives that we can say our only accidents in a given year are those that could not have been prevented, we shall have a safety record and casualty rate of which we can be justly proud.

Safety Meetings

All railroads have some system of safety education. One of the better methods is to hold regular safety meetings, if at all possible. These meetings should be conducted by the employees themselves, with someone present who can advise and carry suggestions along to the proper authorities for action, if action by higher officers is necessary. In these meetings, the employee should be made to feel free to present any suggestions or facts that he feels will improve the safety record of any particular man, gang, or the railroad as a whole. Every statement at these meetings should be given careful consideration, even though some of them may sound unreasonable or unnecessary.

The analysis and discussion of all accidents occurring in the previous period, regardless of whether reportable or non-reportable, have been found to be very beneficial in determining the causes and methods of preventing the repetition of these accidents. The frank discussion among employees of unsafe practices and unsafe conditions observed in their daily contacts will do much to prevent personal injuries and lost time.

Foremen and gang leaders should be chosen for their ability to direct the work in a manner that will insure safety as well as efficiency. Good common sense and the ability to handle men, as he himself would like to be treated, are extremely important to the foreman. Respect for the men under his jurisdiction will do much to promote harmony, and thus cause the work to be carried on in a safe and workmanlike manner.

Safety Rules

A practice adopted by numerous railroads, and a good way in which to keep safety uppermost in the minds of employees, is the "rule-a-day" practice, under which a selected rule is required to be read to all men of each gang before starting the day's work.

Good results can be obtained in reducing casualty rates if supervisors and foremen will rigidly observe the following teachings and rules:

(1) Instill the idea of self-preservation in the mind of each new employee.
(2) Impress upon him the importance of preventing accidents to others.
(3) Teach him to be constantly on the alert.
(4) Keep his mind free of family or other outside troubles.
(5) Teach and thoroughly explain to him all working and safety rules.
(6) Allow no one to willfully break safety rules.
(7) Talk safety constantly.
(8) Practice safety and live safely.
(9) Prevent hazardous conditions.
(10) Sideline the employee who can not or will not accept and practice the teachings of safety.
(11) Require the use of goggles as eye protection.
(12) Rigidly enforce rules pertaining to the use of defective tools or materials.

Safety education along the foregoing lines will tend to produce safety-minded employees, and then the goal of "no accidents" will be in sight.

In conclusion: always remember that "haste makes waste." Even though a "featured" train may be delayed by taking time to do work safely, never forget that outstanding slogan, SAFETY ABOVE EVERYTHING.

Committee Personnel

H. D. Curie (chairman), mast. carp., B. & O., Garrett, Ind.; E. H. Blewer (vice-chairman), supvr.-safety engr., N. Y. C., New York; A. C. Jones (vice-chairman), b. & b. supvr., Southern, Parrish, Ala.; T. D. Osbourne (vice-chairman), asst. b. & b. supvr., S. P., Los Angeles, Cal.; J. L. Anderson, b. & b. supvr., M. P., Osawatomie, Kan.; W. L. Biggerstaff, asst. supt. b. & b., C. N. S. & M., Highwood, Ill.; John E. Bird, asst. supvr. b. & b., N. Y. C., Corning, N. Y.; L. G. Byrd, supvr. b. & b., M. P., Poplar Bluff, Mo.; G. E. Garcelon, supt. b. & b., Bangor & Aroos., Holton, Me.; Chas. F. Gilbert, b. & b., supvr., C. & O., Peru, Ind.; J. E. Gillette, b. & b., fore. (retired), C. M. St. P. & P., Mazomanie, Wis.; A. M. Glander, ch. carp., C. M. St. P. & P., Mason City, Iowa; Sam Lincoln, gen. fore. (retired), A. T. & S. F., Beaumont, Tex.; R. H. Morrison, prin. asst. engr., Bangor & Aroos., Houlton, Me.; B. C. Smart, m. of w. supvr., D. T. & I., Dearborn, Mich.; William A. Stewart, div. supvr. (retired), Cent. Ver., Stafford, Conn., and S. R. Thurman, asst. b. & b. supvr., M. P., Nevada, Mo.

B. & B. SECTION

Discussion

Answering a question raised by J. S. Hancock (D.T.&I.), Chairman Curie stated that the only way to determine when a hose is worn out and unsafe is by cutting off a piece and inspecting the inner lining.

W. A. Sweet (A.T.&S.F.) mentioned that a safety valve is now available, which can be attached to an air hose for assuring a uniform flow of air. In the event of a break in the line, the valve prevents the rapid expulsion of air and the whipping of the hose line.

The practice of equipping bridge gangs with portable telephone sets is becoming more widespread, Chairman Curie said, because such sets not only assist in obtaining information on train schedules, which is essential in safeguarding the movements of men on motor cars, but they also reduce the necessity for stopping trains while work is in progress and permit more complete utilization of the gang's working time. Further discussion on this subject by L. H. White (I.C.), S. L. Chapin (S.P.), W. F. Martens (A.T.&S.F.), and V. W. Hutchings (S.P.) developed that the portable telephone set of the foreman is connected to the dispatcher's line while those furnished flagmen are usually connected only to the foreman's set.

Mr. Chapin spoke of the importance of grounding all electrical power tools, a practice that is made mandatory by law in some states—to preclude injury to workmen by electrical shock.

This Poster, No. 278, Constitutes the November Installment of "All the Year—Every Year Safety Program" of the Safety Section, Association of American Railroads

What's the ANSWER?

Putting Them On at the Plant

Are there any advantages in installing tie plates on ties at the treating plant? Why? Should this be done before or after treatment? How should they be fastened? Any disadvantages?

Disadvantages Greater

By H. R. Clarke
Chief Engineer, Chicago, Burlington & Quincy, Chicago

Possibly there might be advantages in installing tie plates on ties at the treating plant. However, I can visualize disadvantages that are so much greater that the practice does not seem to be practicable. If the plates are to be installed at the tie plant, the installation should obviously be made after the ties have been treated. In preparation for receiving the plates the ties should be adzed and bored prior to treatment to insure the most thorough penetration of the preservative. They should be fastened in the most permanent way, which, I believe, would be by bolting through the tie.

Among the possible advantages are that in this way the plate would be fastened to the tie much more securely than can be done in the field. This should reduce to the minimum relative motion between the plate and the tie, and thus the consequent wear on the tie, with the damage wear creates. Perhaps also, the plate could be fastened more accurately, which should insure better gage.

Against this, the cost would be increased substantially and the ties would be much more difficult and expensive to handle. Since different sections of rail are in use, the distribution of ties would probably be less easy, since it would be essential that ties prepared for any given weight of rail be used under rail of that weight. This is important wherever ties are prebored, but would be absolutely necessary if the plates were fastened to the tie at the plant.

It does not seem that the increased service life to be obtained from ties to which the plates are fastened at the plant will be sufficient to justify the extra cost, compared with fastening the plate to the tie in the field, independently of the spikes holding the rail in position.

Has Been Considered

By I. H. Schram
Chief Engineer, Erie, Cleveland, Ohio

This method of applying tie plates has been considered a number of times on this road, as it seems that our standards are well suited to applying the plates at the treating plant. Each time the subject has been considered, however, analysis has led us to reject the proposal. All of our ties are given preservative treatment. Those for our main tracks are adzed and bored in the treating plant and, in the field, hold-down fastenings, consisting of two standard A.R.E.A. lag screws with double-coil washers, are applied in addition to the rail-holding spikes. We do not double-spike, even on sharp curves, having found this unnecessary with the hold-down spikes. We have used this type of construction for 17 years, and our road is now so equipped throughout, except in some of the lighter-traffic sections of the main line.

To apply the tie plates at the treating plant would require a considerable stock of plates, since they would be applied no matter what use is made of the tie. For instance, if it is for application under 130 or 131-lb. rail that is already tie plated and lagged,

---

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered In January

1. *To what extent should investigations be made of injuries to maintenance-of-way employees? Who should make them? How should the investigations be conducted?*

2. *What are the relative merits of metal and wooden sash for railway buildings? Where can each be used to best advantage? Are there substitutes? If so, what?*

3. *What are the relative merits of crossties, 8, 8½ and 9 ft. long? Do recent developments in the stabilization of track make any difference? If so, in what way?*

4. *Should pipe culverts be equipped with headwalls? Why? What are the advantages? The disadvantages?*

5. *What are the advantages of special foundations under railway crossings? The disadvantages? What type of foundation is most satisfactory? Why? What precautions should be observed? Why?*

6. *What troubles are likely to afflict reciprocating pumps that must handle muddy water? How can they be overcome? Are power requirements affected? How?*

7. *At what time and in what way should a roadmaster or a supervisor go about formulating his program for maintenance work for next spring and summer? What special factors should be given consideration?*

8. *Should anchor bolts for bridge seats, or building columns or for other anchorage of steel members to concrete be installed by template when the concrete is being placed, or should holes be drilled to receive them? Why?*

this would involve removal of these fastenings from the discarded tie, presumably after it has been removed from the track. However, it has been found to be more economical to handle the tie-plate and lag-screw removals either when the ties are spotted in or following a rail renewal, at the time the track is reballasted, by going over the track with a power bolting machine and removing the lag screws.

These are then sorted and reused or classified as scrap.

When the tie is renewed, the tie plate is lifted off the tie and is either reused or classified as scrap. When done in this way, the work of removing the lag screws and plate can be done while the tie is solidly on its bed, where it can be handled easily and where the bolting machine can be used economically. After the tie is out of the track it seldom lies in a position that permits the machine to be used.

On the other hand, it is a fact that, in some cases of reballasting, fairly heavy tie renewals are necessary. Here there would be more chance of economy in fixing the tie plates to the ties at the treating plant, because this would speed up renewals. However, it would mean that shipments to these locations would have to be segregated, making for confusion and switching in the field. It is also a fact that the ties would have to be sorted at the plant where labor is expensive. Larger stocks of tie plates and lag screws would be required and the advantages of machine application would be lost in many ways.

Obviously, if the tie plates were applied at the treating plant, it should be after treatment. They should be fastened with lags having double-coil washers, so they will be set with their shoulders at right angles to the long axis of the tie, and so the gage will be correct.

Disadvantages Outweigh

By District Engineer

From my point of view it would be of distinct advantage to have the tie plates fastened to the ties at the treating plant, provided some way can be devised to insure the plates are affixed so firmly that there will be no relative movement between the tie plate and the tie during the service life of the tie or of the rail. Certainly, it would eliminate a multitude of tie failures and bring some reduction in rail failures. The amount of maintenance now expended would be reduced and yet the track should ride smoother. Labor would be saved, as well as damage to the ties when tamping them and through the gaging of the track. There are a number of other advantages, but those mentioned come to mind most readily in considering the subject.

On the other hand, there would be certain disadvantages, particularly in the replacement of ties that are already tie plated, as most ties are today. This practice would necessitate the carrying of a sufficient stock of tie plates to fit various sections of rail, sometimes over widely separated sections of the road. Obviously the tie plates would have to be affixed after the tie has been treated, and this would require one or two extra handlings, which would tend to build up the cost of the tie, already considered too high by many maintenance officers. There will also be some extra expense for handling ties to which the tie plates have already been fastened. It is my opinion that these disadvantages outweigh the advantages mentioned in the first paragraph.

Reducing the Discharge

What is the best way to reduce temporarily the volume of discharge of a centrifugal pump? Permanently? How does this affect the pump? Does the amount of reduction make any difference?

Throttle the Discharge

By J. P. Hanley
Water Service Inspector, Illinois Central, Chicago

Usually, centrifugal pumps are ordered for definite conditions of use. Among these requirements are the total head, which includes the height of the suction, plus the discharge head and the friction in the pipe and pump itself, expressed as one sum in feet; and the pumpage, expressed in gallons per minute. These requirements are stated in placing the order, but upon receipt it is advisable to make an actual pumping test to determine the pipe-line friction and total head, rather than to calculate the head from friction tables and differences in elevations. This preliminary test will indicate whether there is any obstruction in the pipe line, such as lead projecting from joints, or other foreign matter that may have entered the pipe line.

If the requirements, as specified, have been met, the centrifugal pump will fit the conditions existing at the station. On the other hand, it occurs not infrequently that, in the course of time, long before the pumps become worn, it becomes necessary to relocate them, and they may not fit the new conditions under which they are to be used. In such cases, certain steps may be taken to improve the operation of the pumps, as is suggested in the question.

If the use of the pumps under the new condition is only temporary, then only temporary measures will be needed to fit them for the temporary demands. If the head is less than that for which the pumps were designed the volume of discharge can be reduced merely by throttling the valve on the pump discharge. If the temporary use is for a longer period, an orifice plate may be inserted in the discharge pipe to give the pumpage rate desired. This is generally the safest thing to do, since the plate will be fixed and the discharge will not fluctuate, as may happen with a valve that can be opened and closed.

Another method is to reduce the diameter of the pump impeller. This is the better method, provided the period of temporary use will be of sufficient length to warrant the action. It is also, by far, the better method if the change is to be permanent. Information regarding the pumping curve and the amount of impeller trimming required can be obtained from the manufacturer who furnished the pump. Pump manufacturers are now putting pumps on the market, that allow the use of several sizes of impeller in the same pump casing, and the manufacturer should be solicited for an impeller change, if possible, to meet the changed conditions, before any other action is taken.

Depends on Period

By Supervisor of Water Service

When a centrifugal pump is connected directly to a constant-speed prime mover, and provided the reduction in the volume of the discharge is not large, or where the period during which the reduction is to be made is short, the simplest and most satisfactory way to make the reduction is to throttle a valve on the discharge line. This will reduce the power input, but it will also reduce the efficiency of the pump. The reason for this is that while the volume of the discharge is decreased the head is increased and the additional power re-

quired to overcome this head, which will extend to the throttled valve, will merely be wasted.

If the reduction in the volume of discharge is small, the throttling of the valve on the discharge side of the pump will not be detrimental or injure the pump in any way, and will make no appreciable difference in its normal operation. On the other hand, a reduction of, say, 75 to 90 per cent from its rated capacity would probably subject the pump to internal hydraulic shocks, the effects of which are similar to those of wire drawing of valves when they are throttled closely. To overcome this, the valve used for choking the discharge should be inserted in the line at a considerable distance from the pump. All that has been said about the choking of valves applies also to orifice plates.

If the reduction in the volume of discharge is to be for an extended period, and particularly if the reduction represents a considerable percentage of the rated capacity, then the best thing, from the standpoint of both economy and pump operation, will be to install a new rotating element, the characteristic curve of which should be easily obtainable from the manufacturer, and from this it will be equally easy to determine the cost of power and the relative efficiency of the installation.

Water Pockets in Yards

When troublesome water pockets occur in large yards, what methods can be employed to overcome the trouble?

Study Subject Carefully

By J. P. Datesman
Drainage Engineer, Chicago & North Western, Chicago

Before any action toward the drainage of water pockets is undertaken, whether they be in large yards or in main-line cuts and fills, the whole matter should be studied carefully in the light of recent experiences in the curing of water pockets, to determine whether drainage or roadbed grouting should be given preference. The depth of the water pockets in relation to adjacent topography and of practical outlets are both of prime importance when stabilization methods are under consideration. In addition, these studies should include a comparison of the cost of maintenance under existing conditions and the expenditure necessary to insure stabilization.

If this initial investigation develops that the bottoms of the water pockets are below a natural outlet or will prevent a gradient of at least 0.2 per cent for the drain pipe, the project should be carried out by grouting, for no stabilization can be regarded as permanent or satisfactory unless the drainage is complete and its permanence is assured. If, however, complete drainage can be obtained, it then becomes a matter for the engineer to decide, on the basis of the studies made.

Knowledge that an outlet can be obtained is not, in itself, sufficient. The location of the water pocket relative to that of the outlet may have an important bearing. In other words, the outlet may be so distant from the water pocket that the installation of the pipe necessary to obtain the desired drainage becomes impracticable. Not only the length of the drainage line, but whether it parallels the yard tracks or must be laid across them has an important bearing on what this outlet line will cost. It is obvious that to install a drainage line under a series of yard tracks is an expensive operation, compared with a line parallel to them. The trench for the latter can, in many cases, be formed with a trenching machine at a reasonable figure, whereas the line across the yard requires a hand-dug trench.

A large percentage of the water pockets in yards are produced or aggravated by surface water being impounded above impervious clay in its natural bed or placed in the fill during grading operations. This always results in continual settlement. There are also many cases where water pockets develop as a result of the presence of subsurface water. In such cases the installation of intercepting lines in conjunction with lateral drains under the actual pockets will often eliminate the water and stop the settlement of the track.

Regardless of the method followed, soundings should be taken to establish definitely the depth of the water pockets, so that the grout or the drain pipe, whichever may be used, will be placed at or below the absolute bottom of the water pocket. Investigation of stabilization failures has developed that they were the result of inconclusive soundings. If the pockets have been in existence for a number of years, it is possible that many kinds of ballast have been used to maintain grade, including cinders and other disintegrated material, and the resulting soft strata can be mistaken for the bottom of the pocket.

Both of the methods for stabilization mentioned have their own advantages. For this reason, it does not seem advisable for anyone to follow arbitrarily one method. One should, rather, give careful study and consideration to both methods, from the viewpoints of initial cost, probable maintenance and the results desired.

Has Been Successful

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Elimination of water pockets in yards is essential to good track maintenance in the same way that elimination of water pockets in main-line tracks is essential. The only difference in this respect between the two is that, because of the lower speeds generally maintained in yards, water pockets under yard tracks are seldom as much of a hazard to train operation as when they are in main-line tracks. They often provide as much, or even more, of a problem with respect to their elimination as the main-line soft spots.

One of the reasons why this is so often true is that the yard drainage is poor, or satisfactory outlets are far distant from the seat of the trouble. This is especially true of large yards with their networks of multiple tracks. However, the excavation of parallel ditches or the installation of parallel sub-surface drainage lines, with cross ditches or drain pipes to reach the water pockets, may be a simple and relatively inexpensive solution.

Drainage Best

By Wayne Anderson
Section Foreman, Illinois Central, Indianapolis, Ind.

Drainage not only gives best results in the elimination of water pockets in large yards, but these results are most likely to be permanent. To accomplish this, however, one must be certain that the drainage includes the lowest point in the pocket, or rather, that it should be installed far enough below the lowest point to insure that it will keep on draining if additional water reaches the pocket.

Other suitable methods can be used, conceivably, to provide this drainage, say, perhaps, by under-drains to ditches or to a nearby sewer. Or, if there is no ditch or nearby sewer, a sump might be constructed to draw off the water, which can then be pumped out of the sump.

Driving Piles in Frozen Ground

What methods can be employed for driving piles in frozen ground? What precautions should be taken?

Will Damage Pile

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Under no conditions should it be permitted to drive or to attempt to drive piles through frozen ground, since this will damage the pile as a result of splitting, brooming or breaking. Furthermore, accuracy in driving cannot be assured, even if the pile is of such character, say of steel, that it will not be damaged, and accuracy of driving is an important feature of pile foundation work, regardless of the character of the structure. Accurately-driven piles will reduce the cost of the structure of which they form a part; they usually reduce maintenance costs—invariably in the case of trestles—and eliminate the necessity for recutting and reboring preframed material that is to be used with them.

To insure that each pile will fall in the plane of the bent in which it belongs, it will be necessary to remove the frozen ground by means of picks, bars or drills, making a hole about two inches larger in diameter than that of the pile. After the removal of the frozen ground the holes should be extended to a depth of six to eight feet by means of hand augers. This will not only speed the driving but will also eliminate the need for additional help in setting the piles or for placing collars around them at the ground line. It will also hold the pile vertically and in correct position while it is being driven. This method applies equally to wooden and concrete piles. If timber piles are being employed, it will also reduce the jacking and the spacing of the piles and reduce the cost of applying braces. The entire job will be done with greater economy and with greater neatness as well.

Always Prepare Pilot Hole

By J. P. Dunnagan
Engineer of Bridges, Southern Pacific, San Francisco, Cal.

From time to time we find it necessary to drive piles in frozen ground in Northern California, in Oregon and Nevada. We have not encountered any special difficulty in driving them in frozen ground in these localities, for the frozen crust extends for only a short distance below the surface. At the spot where the pile is to be driven a pilot hole is dug through this frozen crust and from this point the driving proceeds in the ordinary manner.

We encounter our greatest trouble when driving piles in ground containing boulders and sand and, in certain portions of Arizona and New Mexico, where we encounter a hard formation known as caliche, which is a fairly hard sandstone. In this formation we sometimes find it necessary to bore a hole through the stratum to receive the pile. I know of no special precautions that need to be taken, since, except for the pilot hole, the procedure is the same as for ordinary soil and driving conditions.

Would Use Steam

By General Inspector of Bridges

Obviously, wooden piles should never be driven through frozen ground. If an attempt is made to do so it is quite likely that the pile will be damaged so severely that it will become unfit for the use for which it was intended. If the frost does not strike deeply, it is sometimes possible to drive a concrete pile, but I have seen concrete piles damaged to the point where they had to be discarded, when driven in moist ground that was frozen solidly. I understand that heavy-section steel piles can be driven without damage under these conditions, but it seems to me to be a foolish thing to attempt it, except under emergency conditions where time is the most important element to be considered.

There is no serious objection *per se* in driving piles in the winter, but this should always be done under conditions that assure that the piles will not be damaged. The surest and safest way of insuring this is to prepare a pilot hole through the frost stratum. This can be done in several ways—by means of pick or bar, by drill or by thawing. In general, I prefer to use a steam jet to do the necessary thawing, after which an ordinary earth auger can be employed to bore the pilot hole, which should be six to eight feet deep.

The advantage of this method is that the pile gets its start at the correct location, and can be driven either vertically or on a batter, as would have been done in ordinary summer pile driving. After the pilot hole has been prepared, the driving usually can proceed in the ordinary manner and with no greater precautions than for regular routine driving.

Breakage in Skylights

What can be done to minimize the breakage of glass in skylights?

Expansion Usual Cause

By Engineer of Buildings

Before the use of copper and other non-corroding metals, and corrugated wire glass glazed with suitable compounds of mastic, became the common practice in skylight construction, much trouble was encountered from breakage of the glass in the skylights. If it is still necessary to maintain any of these old skylights with wood bars and muntins in wood frames, with flat glass puttied into place, the best method to pursue is to get the wire glass undersized and fasten it into place with screws and then use a good grade of glazing mastic that will not harden. If the skylight is pitched steeply, the glass must be secured against slipping.

The principal trouble with flat glass in skylights, even when it is well secured and suitably glazed, is that in many localities, on a hot summer day, there may be a sudden thunder storm that will drench the heated glass and cause it to crack.

Correctly-designed skylights, with sections of copper or brass, and with wire glass that is held in place with a good mastic, should give no trouble from breakage and should resist corrosion for many years.

A Continuous Problem

By O. G. Wilbur
Assistant to Engineer of Buildings, Baltimore & Ohio, Baltimore, Md.

I do not want to be considered facetious, so I will not follow my first inclination, which is to say "remove the skylight." As everyone knows who has to maintain them, skylights, while a necessary evil, provide a continuous problem for the maintenance forces. If the unit is essential, then the best protection is to build a light

frame above the skylight and cover it with wire mesh. Depending upon the location it is sometimes desirable to build this frame strong enough to support a man walking across the covering. The location will also determine the size of the wire mesh to use, since it may be desirable to use a finer mesh for some locations than for others. The use of wire glass is, of course, desirable, but is not the total solution to skylight protection.

Traced to Lack of Care

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Glass that is employed for skylights is either rough, ribbed, plain or contains wire mesh. Since wire glass ¼ in. thick does not differ much in price from plain glass, the former is used more widely than any of the others mentioned. However, corrugated glass ¼ in. thick is now being used extensively in skylights, because it can be laid directly on the purlins without the necessity for building up frames. One of the advantages of this glass is that expansion and contraction can be cared for easily in the design, thus reducing breakage of the glass in the skylight to the minimum. The size of the panes to be used in a skylight depends to a large extent upon the pitch of the skylight, the smaller sizes being more desirable when the pitch is slight.

My experience indicates that in most cases the breakage of skylight glass can be traced to lack of care in making the original installation. This is particularly true for skylights of the puttyless type, where the fastenings are made too tight when screwing down the capping over the skylight bars. Another basic clause is failure to remove all corroded metal found in any part of the skylight frame. Where the metal is corroding, the frame should be cleaned thoroughly, scraped and then painted with a good linseed-oil paint.

Next, breakage of the glass often occurs where the skylights are laid on too flat a pitch, and this tendency to break is accentuated if the glass is applied in the large sizes. For a given skylight that may be almost, if not entirely, immune to breakage when the plane of the glass is vertical, the breakage may be astonishingly high if this plane is horizontal. Almost invariably the rate of breakage of the glass will increase at a somewhat uniform rate as the angle with the vertical increases.

Another rather common cause, in addition to screwing the bars down tight, is failure to make other provision for expansion, especially failure to provide sufficient clearance between the glass and the frame.

I prefer the welded wire glass, because my experience leads me to believe that it is better than the woven type, since it can be made to coincide more nearly with the central plane of the glass. Experience has also shown that under similar conditions there will be less breakage where welded wire glass is used, where breakage occurs primarily because of extremes of temperature.

Again, I am convinced that the number of separate glass, or panes, in the skylight is a factor in the breakage in skylights, since the larger sizes of glass, in fewer panes, are more likely to deflect under roof loads of snow or ice. It thus becomes imperative that the selection of skylight frames be made carefully.

What Is Efflorescence?

What is efflorescence? How can it be prevented? How cured?

A Deposit of Salt

By Edward L. Rankin
Consulting Architect, Galveston, Tex.

The efflorescence that occurs on masonry surfaces consists of a deposit of crystallized salts, either individually or in company with one or more different salts. The salt most commonly met with in the form of efflorescence is calcium sulphate, more generally known as gypsum. Less frequently, magnesium sulphate, or Epsom salt, sodium and potassium sulphate and sodium chloride, or common salt may be present alone or mixed with any of the others.

These soluble salts may have been in any or all of the masonry materials used in the wall, either the facing or backing, or both. The moisture may have entered the wall during its construction, through later exposure to rain or snow, by way of leaky gutters, improperly applied flashing, because of lack of drips on cornices and sills, or through poorly-fitted or cracked mortar joints in the wall.

Once in the wall, moisture dissolves some of the salts present and later passes to the surface when conditions become favorable for evaporation. Then, when evaporation of the water in which the salts are dissolved takes place, the salts are left behind on the surface of the wall as efflorescence.

Prevention of efflorescence must begin with the design of the building; it must follow through with the selection of the materials and the methods of work during the construction period; it must also continue with the maintenance of the structure after its completion.

The building should be so designed and constructed that water is kept out of the interior of the masonry. If a choice of materials can be made, be sure to select those that are most nearly free from soluble salts. In designing masonry to prevent efflorescence, allow only vertical surfaces to be exposed to the rain, unless suitable and ample flashing of waterproofing materials is to be interposed to prevent the travel of moisture. Water or moisture within the wall will dissolve the salts from the mortar, bricks, etc., and ultimately this water comes to the face of the wall and evaporates, leaving the salts as efflorescence.

It has been discovered that the addition of a small amount of either calcium or ammonium stearate with mortar materials will reduce the extent to which they contribute to efflorescence. These two stearates render the mortar more water-repellent, and an amount of either one, equal to two per cent by weight of the cement, of the lime or of the lime plus the cement, where both lime and cement are used, is suggested. This treatment will practically prevent water penetration of the mortar as a result of capillary forces only.

To cure the trouble once a case of efflorescence afflicts a building, one should check on the possibility of defective construction that permits the entrance of an excessive amount of water into the masonry. The distribution of the efflorescence may give valuable hints about where to look. In any event, construction defects should be remedied, so far as possible. Wash the wall, which previously should have been drenched with clear water, with a solution of muriatic (hydrochloric) acid of a strength not exceeding five per cent. Then wash down with plenty of clean water.

Then wait to see whether the efflorescence returns. If it does, the question of treating the face of the wall can then be considered. If transparent waterproofing is to be used on the face of the wall, wait until warm dry weather before attempting to apply it. The masonry should be dry when this application is made.

Transparent waterproofing materials, when applied to the exposed face of masonry, tend to prevent or retard the entrance of water through the face, yet at the same time will cause little or no change in the appearance of the masonry surface.

Finally, soluble salts in greater or smaller amounts are present in all masonry. But if the wall is so designed and built that water is kept out, there will be no trouble from efflorescence.

Hard Burned Brick Best

By B. M. Murdoch
Engineer of Buildings, Illinois Central, Chicago

Efflorescence is a term used to describe the objectionable white discoloration that often appears on brickwork, and which is the bane of architects and builders, for it often appears on the best of construction and despite efforts to prevent it. It results chiefly from deposits of calcium sulphate, which is a combination of line sulphur in the clay from which the brick are made. The same condition often results from common sulphate or sodium sulphate. The sulphates are soluble in water, and it is capillary attraction which draws them to the surface of the wall to cause the discoloration.

The best preventive is to hard-burn the brick. This not only reduces its porosity, but it also tends to fix or stabilize the calcium content of the clay, so that it has less affinity for moisture. This condition will vary, even in the same run of brick, because of lack of uniformity in the burning in the kiln.

The surest way to avoid trouble with clays having a calcium content is to treat them with barium, which fixes the lime or sulphate content of the clay and prevents the chemical action which would result from its coming in contact with moisture. This process is often used in the manufacture of face brick but is too expensive an operation to be used for common brick.

There is no sure cure for efflorescence, which may, and often does, occur on the best regulated jobs at times. If the brick work is dry and moisture can be prevented from working into it, the discoloration will not occur. The best insurance against its appearance is, then, to use good mortar, see to it that the bricks are laid with good tight joints, and that the walls are flashed and capped to avoid leaks and prevent moisture from working into the masonry. If discoloration should occur, it can be removed by washing the surface with a 10 per cent solution of muriatic acid. If the bricks are very porous, it is advantageous to seal the exposed surfaces with a colorless waterproofing, of which there are many brands on the market, after the surfaces have been cleaned and have had time to become thoroughly dry.

Guard Rails Protecting Curves

Should guard rails protecting curves be bolted or clamped to the running rail? Why? What can be done to prevent the packing of the flangeway with snow and ice?

No Apparent Need

By Roadmaster

It seems to me there is no apparent need for close guard rails to protect curves, other than in paved areas, where it is best to have the guard rail as an integral part of the rail, such as the heavy girder rail. Even in such places, the guard rail is more for providing flangeways than for protecting the curve. Such flangeways are cleaned usually by the wheel flanges, except in those rare cases when they may have to be cleaned before the track is used. One type of guard-rail installation, to prevent wear on the outer rail of the curve, may have some merit where traffic conditions are such that there is a wide range of traffic around the curve, as at a junction, but the disadvantages far overshadow the advantages.

Careful study of wheel stresses on sharp curves indicates that lubrication of the gage side of the outer rail will do everything that a close guard rail will do, and thus eliminates the necessity for flange guards on the inside rail. It has been found that in some places where, for some mistaken reason, a flange guard has been placed on the inside rail, some car flanges may ride up on the flange-worn gage side of the outer rail, and the flanges of the inside wheels may nick the top of the guard rail. Such action makes the inside guard rail more of a liability than an asset.

Difficult to Maintain

By Troy West
Engineer of Track, Union Railroad, East Pittsburgh, Pa.

When installing guard rails on curves either to prevent derailments or to reduce flange wear on the outside rail, fastenings suitable for this purpose should be used. This will involve additional initial cost, however, as well as additional maintenance expense. Both of these factors should be given consideration, in the light of economy and whether a safer track is produced through this construction. On the other hand, a guard rail that is installed independently of the running rail to trap derailed wheels, requires no special construction and is, therefore, no particular problem.

Regardless of how the former is attached to the running rail, it presents a difficult problem with respect to both construction and maintenance. When the guard and main rails are bolted together, keyed wedges or filler blocks should be used to provide the flangeway, and a special tie plate is necessary to insure a stable rail. The bolt holes for the blocks on the heavier rail sections should be at least 1¼ in. in diameter, although they become stress raisers. Owing to the double thrust imposed on the running rail, the cutting of spikes will result, allowing relative motion between the tie plates and the ties, causing excessive mechanical damage to the ties.

If the guard rail is clamped to the running rail, the clamps tend to work loose, allowing the rail to tilt, for which reasonable provision should be made to correct this weakness. Some success in this matter may be attained by using a double-seated tie plate, with inside spike holes for the running rail, or an inside clip that fits against the base of the running and guard rails. This, however, involves the use of special materials.

It is not good construction to clamp a guard rail to a running rail of the same section on a curve, with a throat opening of, say, 2¼ in., and then place only outside spikes. The purpose of a guard rail on a curve should not be confused with the purpose of guard rails on crossings and at frogs.

The use of neither bolts nor clamps as types of fastenings for guard rails on curves is satisfactory. Not only is it difficult to prevent the packing of the flangeway with snow and ice in

the winter, but accumulations of dirt during the warmer seasons must also be removed. To prevent snow and ice from packing the flangeway one must sweep or pick them out or apply heat to melt them. If the track contains track circuits, broken-rail protection is sacrificed. All of these factors are phases of a problem which, I believe, can best be solved by constructing a track that is safe without the installation of the guard rail.

Any curved track can be made to take safely the traffic for which it is built without the use of a close flanged guard rail, by observing strictly certain basic facts that concern good track construction. First, the curve should be spiraled and built to true alinement and grade. It should be given the correct superelevation, with due regard to uniform runoff for the approaches, which can be worked in with the spiral. On the sharper curves the gage should be widened within recognized limits to provide for lateral movement of locomotives without forcing the track. Double-shoulder canted tie plates, together with adequate track anchorage, should be used. Flange lubrication for the outside rail will more than offset the protection given by the guard rail. An adequate ballast section and a well-drained roadbed are essential to this type of construction; otherwise the required standard of maintenance cannot be assured.

Uniform Contraction of Rail

Of what importance is uniform contraction of rail in cold weather? Why? If important, what measures can be taken to insure it?

Need Rail Anchors

By J. E. Fanning
Assistant to Chief Engineer, Illinois Central, Chicago

Much has been said about the necessity for providing uniform expansion of rail to prevent buckling in hot weather. It is important, likewise, that the spacing be uniform during the winter months to avoid rail-end batter and undue pull on the bolts when the rail has contracted under low temperature. If the rail is allowed to creep from its original position, the tendency is for it to buckle at low-grade points during the summer and to pull apart or break near the summit of the grade in winter. When the spacing of the rail gaps thus becomes uneven, the rail is easily fractured by blows, such as might result from a flat wheel or a poorly counterbalanced locomotive driving wheel.

Failure to hold correct or uniform rail-end spacing will result in rough-riding track and will increase the cost of both operation and maintenance. The damaging effect of excessively wide rail gaps is not confined to the running surface of the rail, however, for the fishing or contact surfaces between the rail and the joint bars soon become worn, making it impossible to keep the joints tight. In some instances, the pull resulting from contraction may be sufficient to break the bolts and separate the rail at the joint, creating a hazard to safety or causing delay to traffic.

To provide for uniform contraction of rail in cold weather, the first requisite is an adequate number of effective anti-creepers to prevent the creeping of the rail, while the second, of equal importance, is to keep the fishing surfaces of both the rail and the joint bars well lubricated, to permit free relative movement between the two.

If these two important items of maintenance are neglected, much damage will be done to the rail, and considerable expense will be involved in correcting the condition. For these reasons, those in charge of track maintenance should not relax their efforts to prevent rail from creeping and should see to it that, so far as possible, each individual rail is free to expand or contract as the temperature rises or falls, without exerting excessive stress in the form of pressure or pull on the adjacent rails.

Only One Step

By Supervisor of Track

Provision for uniform expansion when laying rail in cold weather is just as important as when it is laid during the summer. The way to assure that this provision will be made is to see to it that the correct thickness of shims is applied so that all joint gaps will be the same and that they correspond to the temperature requirements of the rail as it is being laid.

Obtaining the correct expansion is only one step in the maintenance of the rail, since it will avail nothing, regardless of the care that may be exercised to assure it in the first place, if no measures are taken to maintain it later. The only way this can be done with full assurance is to apply enough anti-creepers to prevent movement of the rail under traffic and temperature changes. However, this anchorage must be accompanied by bolts drawn to the correct tension so that the rail ends will be free to move in expansion and contraction.

Many trackmen take the position that uniform contraction during cold weather is not as important as uniform expansion during warm or hot weather. They argue that lack of uniformity in expansion is likely to cause the track to buckle under sudden rises in temperature, whereas this hazard does not exist during periods of cold weather.

On the other hand, excess contraction and lack of uniformity in contraction are quite likely to cause bolts to sear and may cause a serious derailment. Furthermore, wide gaps at the rail ends cause excessive rail-end batter and heavy wear on the fishing surfaces of both the rail and the joint bars. Therefore, I consider uniform contraction of equal importance with uniform expansion.

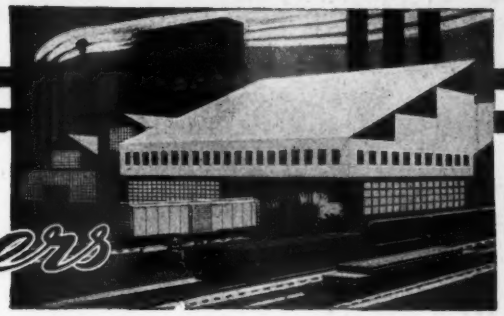
Must Watch Carefully

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

Uniform contraction of rail in cold weather is just as important as uniform expansion when the weather starts to warm up at the beginning of the spring and summer seasons. At the beginning of warm weather it is good practice to watch expansion carefully and loosen bolts at wide joints, thus allowing these gaps to close up and thus to adjust the expansion automatically. The same idea applies when cold weather starts, although the operation is done in reverse. Foremen should know where their rail has been somewhat tight during the warm weather, and such places should be watched and the bolts loosened at appropriate joints so that the contraction will be adjusted automatically, as the expansion was at the beginning of the warm season.

In this way, if handled with care and judgment, expansion and contraction at joints may be kept fairly uniform and not all accumulated at certain weak points where excessive joint movement may occur. During cooling or cold weather, it is important that the bolts be kept tight at all times, so that when joint contraction is adjusted in the manner described the desired results will be obtained.

PRODUCTS of Manufacturers



New Fairmont Products

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has introduced three new products, namely, a special torch designed for igniting dead weeds and grass along the right of way; a hand tool for breaking off "frozen" nuts in timber bridge structures; and a roadbed grouting outfit.

Torch

The torch consists essentially of a hand-held tubular fuel reservoir to one end of which is attached a curved pipe with a wick at the end. It is of sufficient length to permit the operator to drag the torch along the ground at a safe distance from the flame while igniting the material. Kerosene or fortnight oil can be used as fuel and the amount that is fed to the wick is controlled by a needle valve. The capacity of the fuel reservoir is 1¾ pints, and the consumption is a half pint per hour with the valve open 1/6 of a turn.

Using the Right-of-Way Torch to Ignite Weeds and Grass

Bolt Breaker

The bolt breaker is a wrench-like tool which is used by placing the head over the "frozen" nut and then working the handle up and down in a pumping movement. Usually three to five such movements are said to be sufficient to break the bolt just inside the nut. The breaker is manufactured in two sizes, the 44500 for ¾-in. American Standard regular nuts, with a wrench opening of 1⅛ in., and the 44501 for ¾-in. American Standard heavy nuts, with a wrench opening of 1¼in. The head is of high alloy, heat-treated steel attached to a tubular steel handle having an outside diameter of 1-5/16 in. The tool is 36 in. long and weighs 6 lb.

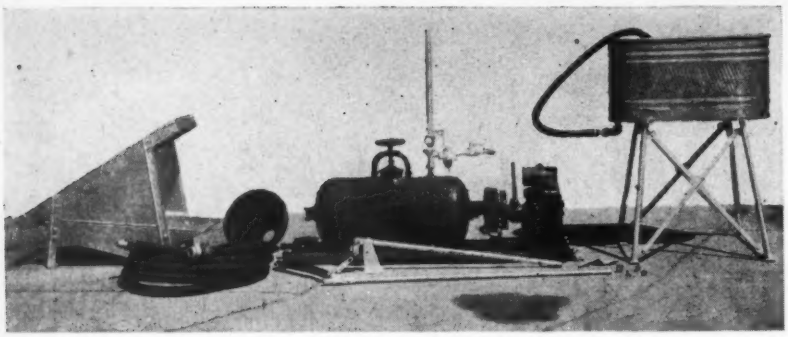
The Bolt-Breaker in Operation

Grouting Outfit

The roadbed grouting outfit, known as Fairmont W65 Series A, is said to provide all the necessary tools and equipment needed for grouting work, other than a compressor of 60 cu. ft. per min. output, a pneumatic paving breaker, and a means of transporting water. It is said that the outfit is simple in operation, compact when in use or in storage, and highly portable, and that all items are relatively light in weight and easily handled.

The principal elements of the outfit include a mixer with a total capacity of 7.6 cu. ft., which is driven by a single-cylinder, air-cooled engine having a governor, clutch and power take-off; an all-steel inclined screen, with a hopper in the bottom for holding the screened sand; an elevated water tank of 94-gal. capacity, which has a hose with an automatic valve nozzle; a 650-gal. water storage tank; a manually-operated hand water pump with a capacity of 2,000 gal. per hr., equipped with 25 ft. of suction hose and 100 ft. of discharge hose, which is used to transfer water from the storage tank to the elevated tank; and an engine-driven centrifugal pump of 3,000 gal. per hr. capacity, with 25 ft. of suction hose and 50 ft. of discharge hose, which is used to pump water from streams, ditches, etc., into the storage tank, and also for other water handling.

Other items in the outfit include 22 grout injectors of three different lengths (with short hoses and couplings), injector pipes, punch rods, driving heads, bull points, an injector puller, five 50-ft. air hoses with assorted connectors, a complete hose-repair outfit, a 9-ft. by 12-ft. canvas cover, and two scoop shovels. For handling and moving the mixer a two-



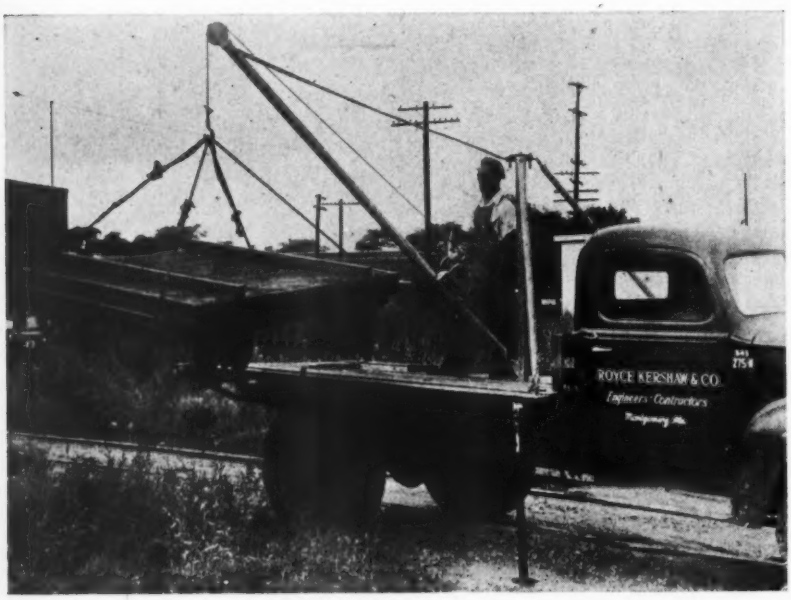
Some of the Principal Parts of the Fairmont Roadbed Grouting Outfit

wheel dolly car is provided. It is claimed that, once the mixer is in place on the dolly, one man can move it along the track with ease.

Engine-driven paddles in the mixer agitate the grout during the mixing and injection period; thus, it is said, insuring positive and uniform mixing. The drive is by a V-belt and an enclosed ball-bearing, helical-gear, reduction unit. The mixer shaft has double-row ball bearings and single roller bearings with seals, and, in addition, has grease-lubricated multiple seals to prevent the entrance of grout. An average of four cubic feet of material can be handled at one time in the mixer, and the unit is so constructed that mixing is said to be complete as soon as the last of the ingredients has been added. The tank of the mixer is tested to 400 lb. per sq. in. pressure, and is fitted with a rock trap at the outlet to catch such material as may accidentally get into the machine. The grout is injected by air, and it is said that a well-organized crew using this outfit can complete the cycle of mixing and injection in three and one-half to four minutes.

Kershaw Derrick

THE Kershaw Company, Inc., Montgomery, Ala., has developed a demountable derrick for use on highway trucks, which is an adaptation of this company's track-mounted derrick. This derrick is of an A-frame design and is of all-steel construction. For on-track use the derrick is mounted on a specially designed push car, with all members fastened to the body of the push car by pin connections. In this version the compression members are fabricated from 2½-in. heavy steel pipe and the tension members of ¾-in. steel rods. Each member is so designed that all joints of the frame are pin-connected. A hand-operated hoist mounted on the boom provides the power for the ⅜-in. plow steel lifting cable. The load capacity of the rail derrick at a 7-ft. radius is two tons.



The Kershaw Truck-Mounted Derrick Handling a Push Car

As adapted for use on motor trucks the derrick has a lifting capacity of one ton and is similar in design, construction and operation to the track-mounted model. It is said that the A-frame, mast and boom may be pin-connected in several positions on any type truck body and that, being completely demountable, the assembly can be stored underneath the truck bed when not in use. It is claimed one man can erect or disassemble the unit in a brief period, and that substantial labor savings can be realized from the use of this equipment in the handling of railway maintenance materials and roadway machines.

Simplex Ball-Bearing Bridge Jack

TEMPLETON, Kenly & Co., Chicago, has introduced a new ball-bearing bridge and industrial jack with a capacity of 25 tons, which is said to be designed for heavy-duty lifting, lowering and supporting work.

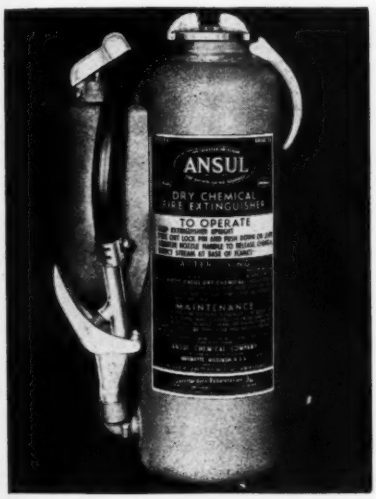
This jack, known as No. 2522, has a closed height of 22 in., a rise of 10¼ in., and weighs 140 lb. In addition to the corrugated top cap, a lifting surface is also provided by a toe lift located 4⅜ in. above the ground level, which has an area of 10 sq. in.

The Simplex 25-Ton Ball-Bearing Bridge and Industrial Jack

The ratchet and related elevating mechanism are fully enclosed and are located at the top of the jack for greater clearance and easier operation. Thrust bearings in the new jack are of chrome-molybdenum steel, and the elevating sleeve, the lifting screw and the gears are of alloy steel.

Dry Chemical Fire Extinguisher

A NEW dry-chemical fire extinguisher has been announced by the Ansul Chemical Company, Fire Extinguisher Division, Marinette, Wis. Advantages claimed for the new extinguisher are simplified and fast



One of the New Ansul Dry Chemical Fire Extinguishers

operation, the ability to be recharged easily and quickly on the spot, a high degree of heat-shielding protection for the operator, and the fact that it makes possible expert extinguishing by inexperienced operators.

New Books

A. R. E. A. Proceedings

PROCEEDINGS of the American Railway Engineering Association for 1946. 786 pages, illustrated. Published by the Association, 59 East Van Buren Street, Chicago. Bound in cloth—$8.00; in half morocco, $9.00.

THIS volume contains the complete record of the activities of the association for the year ending with the annual convention last March, and includes the reports of 19 committees and the discussions that followed their presentation at the convention, together with a number of monographs on highly technical subjects. The subjects covered in the various reports, which number a total of 86, deal with nearly every phase of railway construction and maintenance, and while many of them reflect wartime conditions, they include the latest information relative to economy in engineering and maintenance practices. Again in the 1946 Proceedings, substantially all of the reports represent the result of several years intensive study by the respective committees.

Space will not permit a review or complete listing of the individual committee reports, but the following assignment references will indicate the wide range of subjects covered: Appreciation of University Training by Railway Officers; Government Regulations Pertaining to Railway Sanitation; Conserving Labor and Materials in Water Service; Color Dynamics in Increasing Efficiency; Organization, Machinery and Tools for the Repair of Maintenance of Way Work Equipment; Diesel Engines; Roadbed Stabilization; Splitting and Mechanical Wear of Ties; Life of Steel Castings Immersed in Sea Water; Termite Destruction and Prevention; Housing and Transportation of Maintenance Forces; Shelly Spots and Head Checks in Rail; Development in Rail Design; Renewing Creosoted Timber, Ballasted-Deck Trestles; Impact on Railway Bridges; Research on Welded Structures; Waterproofing of Railway Structures; and preliminary reports on Stress Measurements on Various Designs of Solid Manganese Crossing Frogs, and on the Effect of the Form of Tie Plate Seats on Stresses in Rail Base Flanges and Lower Web Fillets.

Reports of special interest to operating officers include those on: The Length of Sidings for Freight Train Operation; Economics of Railway Location and Operation as Affected by Electrification; Produce Terminals; and Reduction in Maintenance of Way Clerical Work and Reports.

The technical monographs included in the Proceedings deal with the Determination of Lateral Outward Forces on Each Rail of a Turnout, by H. E. Durham, track engineer, Engineering division, Association of American Railroads, Chicago; Two Problems in Bridge Design, by L. T. Wyly, associate professor of civil engineering, Northwestern University, Evanston, Ill.; and The Effect of the Ratio of Wheel Diameter to Wheel Load on Extent of Rail Damage, by N. J. Alleman, special research associate professor of engineering materials, University of Illinois, Urbana, Ill.

As in past years, the Proceedings also includes the usual statistical reports on such matters as crosstie renewals, rail failures, and service tests of treated wood.

Welding Handbook

MANUAL of Design for Arc-Welded Steel Structures. 281 pages, 6 in. by 9 in., illustrated. Bound in leatherette. Published by Air Reduction Sales Company, 60 E. 42nd St., New York 17, N.Y. Price $2.00.

THIS book is designed for use as a handbook of structural welding design, comparable to those portions of steel handbooks which supply information on the design and details of riveted joints and connections. It provides a comprehensive source of information to aid in the design of welded steel structures and will, in addition, serve as a supplementary text for engineering students. The welding methods and practices described are based on the standards of the American Welding Society, the American Institute of Steel Construction, and the Structural Steel committee of the Welding Research Council. The book was compiled by LaMotte Grover, an engineer well known in the field of structural welding.

A generous amount of tabular material is included, a feature of which is a complete set of beam safe-load tables, in which are shown standardized welded connections for each size of beam and each span length. In these tables the designer will find as many as three different welded connections for each situation, usually an angle seat, a tee seat, or a pair of framing angles. Also included is a complete set of design diagrams for weld groups in connections that are subjected to eccentric loading.

Discussions of various subjects pertaining to welding, such as general specifications, electrodes, types of welds, welding terms, definitions and symbols, qualification of welders and shop painting practices, are included. A chapter on the inspection of structural welding, which includes references to more complete treatises on inspection, will be of considerable value to engineers. The manual presumes a knowledge of applied mechanics and strength of materials, but a considerable amount of elementary information is also included, particularly with reference to the design of welded construction.

Changes in Railway Personnel

General

W. T. Rice, supervisor of track on the Richmond, Fredericksburg & Potomac, at Fredericksburg, Va., has been appointed superintendent of the Potomac Yard, with headquarters at Alexandria, Va.

T. C. Macnabb, general superintendent of the New Brunswick district of the Canadian Pacific, at Saint John, N.B., and an engineer by training and experience, has retired after 47 years of service.

E. B. Stanton, engineer maintenance of way on the Spokane, Portland & Seattle, at Portland, Ore, has been appointed assistant general manager and engineer maintenance of way, with headquarters at Portland.

Thomas S. Woods, manager of personnel on the Baltimore & Ohio Chicago Terminal, at Chicago, and an engineer by training and experience, has been appointed assistant director of personnel on the Baltimore & Ohio, with headquarters at Baltimore, Md.

James M. Symes, vice-president of the Western region of the Pennsylvania, at Chicago, and former vice-president of the Association of American Railroads, in charge of operation and maintenance, has been promoted to deputy vice-president in charge of operation of the Pennsylvania, with headquarters at Philadelphia, Pa. **Paul E. Feucht,** general manager of the Central region, at Pittsburgh, Pa., and an engineer by training and experience, has been advanced to vice-president of the Western region, with headquarters at Chicago, succeeding Mr. Symes. **Herman H. Pevler,** general manager of the Western region, at Chicago, and an engineer by training and experience, becomes general manager at Pittsburgh, replacing Mr. Feucht. **Walter W. Patchell,** assistant to the vice-president-operation, at Philadelphia, and an engineer by training and experience, has been advanced to general manager of the Western region, with headquarters at Chicago, where he succeeds Mr. Pevler.

Mr. Feucht was born at Indianapolis, Ind., and is a graduate of Purdue University. He entered the service of the Pennsylvania in 1923, as assistant in the engineer corps at Louisville, Ky. He later served at Philadelphia, Indianapolis and Tyrone, Pa., and was advanced to supervisor on the Schuylkill division in 1929. He returned to Tyrone as supervisor in 1930, and in 1933 was promoted to division engineer of the Renovo division. In 1934 he was made division engineer of the Fort Wayne division, and the following year he was advanced to superintendent of the Wilkes-Barre division. He became superintendent of passenger transportation, Eastern region, in 1936. Other advancements of Mr. Feucht are as follows: 1939, general superintendent of the Southwestern division at Indianapolis; 1942, general superintendent at Cleveland; 1945, general manager at Chicago. On February 1, 1946, he was promoted to general manager at Pittsburgh, which position he held until his current promotion.

Mr. Patchell was born at Philadelphia, and is a graduate of Pennsylvania State College. He began his career with the Pennsylvania in 1915 as a draftsman. In 1920 he was advanced to assistant to the division engineer of the Conemaugh division, and later served successively as assistant supervisor, supervisor and division engineer on several divisions. He was appointed superintendent of passenger transportation at Pittsburgh in 1933, and the following year he served in the general office at Philadelphia and on several divisions as superintendent. In 1938 he returned to Philadelphia for work in the office of the chief electrical engineer, and in the succeeding year was made general superintendent at Cleveland. Two years later, Mr. Patchell was transferred to Harrisburg, Pa., and on February 16, 1942, he was advanced to assistant to vice-president-operation, which position he held at the time of his current promotion.

Engineering

Sidney T. Corey, office engineer on the Chicago, Rock Island & Pacific, with headquarters at Chicago, has retired.

A. S. B. Wass, assistant engineer of construction of the Canadian National, with headquarters at Toronto, Ont., has retired after 32 years of railroad service.

A. W. Owen, junior engineer on the Southern, has been appointed assistant engineer, with headquarters at Cincinnati, Ohio.

H. McNeil has been appointed assistant engineer of construction on the Canadian National, with headquarters at Toronto, Ont.

L. L. Shirey, designing engineer on the Chesapeake & Ohio, has been appointed asistant bridge engineer, with headquarters as before at Richmond, Va.

G. H. Maxwell, office engineer on the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has retired after 44 years of service.

E. H. Marton, assistant engineer in the office of the division engineer of the New York Central, at Chicago, has been appointed industrial engineer, with the same headquarters.

Arthur B. Fowler, assistant engineer in the engineering department of the Erie, at Cleveland, Ohio, has been appointed superintendent of construction, with the same headquarters.

N. Dixon, assistant engineer of the Canadian National, St. Lawrence division, at Montreal, Que., has been appointed bridge and building master there, succeeding **T. H. Harrington,** who has retired after long service.

J. A. Blalock, assistant division engineer assigned to the Potomac yard of the Richmond, Fredericksburg & Potomac, at Alexandria, Va., has been transferred to Fredericksburg, Va.

W. B. Jacobson has been appointed division engineer on the Denver & Rio Grande Western, with headquarters at Pueblo, Colo., succeeding **G. S. Turner,** whose appointment as chief engineer of the Denver & Salt Lake, with headquarters at Denver, Colo., was reported in the October issue.

Max Nearing has been appointed assistant division engineer on the New York Central, with headquarters at Cleveland, Ohio, succeeding **W. A. Bogert,** who has been transferred to the Toledo division with headquarters at Toledo, Ohio. **K. E. Dunn** has been appointed assistant division engineer, with headquarters at Columbus, Ohio. **C. A. Geiger** has been appointed assistant division engineer, with headquarters at Erie, Pa.

J. F. Salmon, whose appointment as bridge engineer of the Canadian National, at Toronto, Ont., was announced in the September issue, was born at Surrey,

J. F. Salmon

England, and educated at Edinburgh, Scotland, and began his railway career with the Intercolonial (now part of the C. N. R.) as a draftsman at Moncton, N.B., in 1913. In 1920 he became chief structural draftsman at Toronto, Ont., and in 1924 was promoted to designing bridge engineer. Mr. Salmon was appointed assistant engineer in January, 1928, and maintained that post until his recent advancement.

W. H. Rochester, assistant chief engineer on the Atchison, Topeka & Santa Fe, Coast Lines, at Los Angeles, Cal., has been appointed chief engineer of the road's Gulf Lines, with headquarters at Galveston, Tex., succeeding **W. W. Wilson,** who has retired. **H. E. Wilson,** division engineer at La Junta, Colo., has been appointed district engineer of the Los Angeles, Valley and Terminal divisions, with headquarters at Los Angeles.

F. W. Campbell, whose appointment as division engineer on the Canadian National, with headquarters at Belleville, Ont., was reported in the October issue, was born at Toronto, Ont., and entered railroad service in 1926 as an instrumentman at Capreol, Ont. In the following

year he was promoted to assistant engineer at Hornepayne, Ont., and served in that capacity until 1929, when he was transferred to St. Thomas, Ont. Released from the Canadian armed forces early in 1945, Mr. Campbell returned to the Canadian National as assistant division engineer at Belleville, the position he held at the time of his recent promotion.

Grey W. Curtiss, whose appointment as district engineer of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., was announced in the August issue, was born on June 24,

G. W. Curtiss

1884, at New Haven, and was graduated from Sheffield Scientific School of Yale university in 1905. He entered railroading with the New Haven the same year as rodman inspector, advancing to inspector transitman in 1906 and chief of party in 1910. He served from 1911 to 1922 as resident engineer, assistant engineer, assistant contract engineer, and track supervisor, successively. In March, 1922, he was named assistant division engineer on the New Haven and New London division, becoming division engineer, Danbury division, in 1926. Mr. Curtiss transferred to the New Haven division in 1929, maintaining the post of division engineer until his recent appointment.

C. P. Disney, whose retirement as bridge engineer of the Canadian National at Toronto, Ont., was announced in the September issue, was born at Montreal, Que., and entered railroading in 1904 as bridge engineer at Ottawa, Ont. In 1914 he served the Intercolonial (now the C. N. R.) at Moncton, N. B., leaving to serve with the British Army overseas from 1915 to 1919. Upon demobilization he resumed his career with the Canadian National in December, 1919, as acting bridge engineer at Toronto, where he was named bridge engineer in October, 1922. Mr. Disney then held that position uninterruptedly until his recent retirement.

G. C. Torrens, acting engineer of track on the Canadian National, at Moncton, N.B., has retired after more than 40 years of railroad service. Mr. Torrens was born at Fredericton, N.B., in 1884, and entered the service of the Canadian National in 1904 as a draftsman in the office of the chief engineer at Moncton. In 1914 he became engineer in charge Campbellton, N.B., and later in the same year he returned to Moncton as assistant engineer. Mr. Torrens was appointed senior transitman at Truro, N.S., in 1916, and later he became acting resident engineer at Moncton. In 1918 he was appointed resident engineer, and two years later he became division engineer. He joined the maintenance of way department in 1942 as acting engineer. Later he became acting engineer of track, the position he held at the time of his retirement.

William T. Dorrance, whose appointment as consulting engineer of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., was reported in the August issue, was born on July 30, 1873, at Providence, R. I., and was graduated from Brown university in 1894 and Massachusetts Institute of Technology in 1896. During 1897 and 1898, Mr. Dorrance served as rodman and instrumentman on the construction of South Station in Boston, Mass., then joined the Buffalo, Rochester & Pittsburgh (now part of the Baltimore & Ohio) as assistant engineer. In 1902, he went with the New York Central, and was appointed engineer of construction in 1906, leaving in 1911. From 1912 to 1914, he served the Portland Terminal Company and the East Boston Company. During 1914 and 1915, he served the Boston, Revere Beach & Lynn (elec-

W. T. Dorrance

tric) in the construction of a drawbridge and enginehouse. Mr. Dorrance joined the New Haven in 1915, in the valuation department, and became chief draftsman in 1916. He was advanced to designing enginer in 1920, then to assistant to chief engineer in 1931. He held the latter post until his recent appointment.

R. H. Emmerson, whose retirement as engineer, right of way, on the Canadian National, with headquarters at Moncton, N.B., was announced in the October issue, was born at Dorchester, N.B., in 1880, and was graduated from Mount Alliston University in 1901 with the degree of B. A., and from McGill University in 1908 with the degree of B. S. He entered the service of the Canadian National in 1899 as a clerk in the office of the general superintendent at Moncton, and transferred to the engineering department in 1902. In 1903 he became a draftsman, and in 1910 he was appointed division engineer with headquarters at Levis, Que. He returned to Moncton as division engineer in 1913, and in 1915 he was appointed assistant engineer. In 1943 he was appointed engineer, right of way, at Moncton, the position he held at the time of his retirement.

D. M. Trotter, division engineer on the Canadian National, with headquarters at Hornepayne, Ont., has been transferred to the St. Lawrence division, with headquarters at Montreal, Que., where he succeeds **Hector MacNeil,** whose appointment as assistant engineer of construction, with headquarters at Toronto, Ont., was reported in the October issue.

Mr. Trotter entered the service of the Canadian National in 1936, and subsequent to serving in various capacities in the northern Ontario district, was appointed division engineer at Hornepayne.

G. S. Turner, whose appointment as chief engineer of the Denver & Salt Lake, with headquarters at Denver, Colo., was reported in the October issue, was born at Long Island, Kan., on July 4, 1888, and received his higher education at the Colorado School of Agriculture. He entered railroad service in 1917 as a draftsman on the Denver & Rio Grande Western, at Pueblo, Colo., and served in that capacity until 1921, when he became assistant engineer, with the same headquarters. In 1932 Mr. Turner became assistant engineer on the Denver & Salt Lake, serving first on the construction of the Dotsero Cutoff, and later at Denver. From 1936 to 1941 he served as engineer maintenance of way, at Denver, returning in the latter year to the Denver & Rio Grande Western as roadmaster, with headquarters at Helper, Utah. In 1942 he was appointed division engineer, with headquarters at Pueblo, the position he held at the time of his recent promotion.

Track

H. C. Cutshall, roadmaster on the New York, Chicago & St. Louis, with headquarters at Delphos, Ohio, has retired after 38 years of service. **John H. Dunn,** roadmaster at Fort Wayne, Ind., has retired after 27 years of service.

A. G. Miner has been appointed track supervisor on the Atchison, Topeka & Santa Fe, with headquarters at Lakin, Kan., succeeding **B. F. Wyrick,** who has been transferred to Colorado Springs, Colo., where he replaces **J. T. Onan.**

Stuart Shumate has been appointed supervisor of track of the Potomac yard of the Richmond, Fredericksburg & Potomac, with headquarters at Alexandria, Va. He was formerly supervisor of track on the Pennsylvania, at Columbus, Ohio.

P. E. Chapin has been appointed supervisor of track on the Chicago division of the Chesapeake & Ohio, with headquarters at Peru, Ind., a newly created position.

J. F. Selby, roadmaster on the Denver & Rio Grande Western, at Salt Lake City, Utah, has been appointed trainmaster-roadmaster, with headquarters at Gunnison, Colo. **H. V. Meck** has been appointed roadmaster at Salt Lake City, where he succeeds Mr. Selby. **H. O. Chappell** has

been appointed roadmaster at Pueblo, Colo. **R. A. Walker,** roadmaster at Green River, Utah, has been transferred to Grand Junction, Colo., where he succeeds **Eugene C. Hightower,** who has retired after 47 years of railroad service.

E. Westlund has been appointed acting roadmaster on the Canadian National, with headquarters at Mirror, Alta., succeeding **K. G. Nilsson,** whose appointment as bridge and building master, with headquarters at Clagary, Alta., is reported elsewhere in these columns.

T. C. Netherton, Jr., assistant supervisor of track on the Pittsburgh division of the Pennsylvania, at Cresson, Pa., has been transferred to Trenton, N.J., succeeding **G. W. Dabbs,** resigned. **E. J. Maggie,** assistant on the engineer corps at Buffalo, N.Y., has been promoted to assistant supervisor of track, with headquarters at Cresson, replacing Mr. Netherton.

J. F. Anglin has been appointed assistant roadmaster on the Scioto division of the Norfolk & Western, with headquarters at Portsmouth, Ohio, succeeding **W. O. Tracy, Jr.,** whose promotion to roadmaster at Iaeger, W. Va., was reported in the October issue. **B. H. Lester** has been appointed assistant roadmaster of the Norfolk division, with headquarters at Crewe, Va., succeeding **H. L. Woolwine,** promoted.

F. H. C. Graves, assistant supervisor of track on the Boston & Albany at Springfield, Mass., has been promoted to supervisor of track at Pittsfield, Mass., succeeding **Fred Schauble,** who retired from active service on October 31. **Charles Baulkwill,** assistant supervisor of track on Subdivision No. 2 of the Electric division of the New York Central, at Harmon, N. Y., has been transferred to the Boston & Albany at Springfield, relieving Mr. Graves, and **Robert J. Klueh,** assistant supervisor of track on Subdivision No. 9 of the Syracuse division at Syracuse, N. Y., has been transferred to Harmon, replacing Mr. Baulkwill.

J. L. Alter, acting roadmaster on the Atchison, Topeka & Santa Fe, has been promoted to roadmaster, with headquarters as before at Los Angeles, Cal., succeeding **W. C. Cagle,** who has retired. **E. E. Rury,** assistant roadmaster at San Bernardino, Cal., has been transferred to Los Angeles. **P. E. Scogin,** track supervisor on the Atchison, Topeka & Santa Fe, at Chanute, Kan., has been promoted to roadmaster, with the same headquarters, succeeding **H. W. Green,** who has been transferred to Arkansas City, Kan., where he replaces **C. Kelley,** who has retired. **C. I. Thompson,** section foreman at Moline, Kan., has been appointed track supervisor at Chanute, succeeding Mr. Scogin.

W. E. Griffiths, division engineer on the Canadian National, with headquarters at Montreal, Que., has been appointed general maintenance inspector, with the same headquarters, succeeding **W. H. McGaan,** who has retired.

Mr. Griffiths was born at Ilford, England, and was graduated from McGill University in 1931. Subsequent to serving with a number of engineering companies and as an engineer for the city of Toronto, he entered railroad service in 1937 as a concrete inspector on the Canadian National. Later, he served as instrumentman, assistant engineer, and assistant division engineer at Montreal. In 1944 he was appointed division engineer at Ottawa, Que. In 1946, he was transferred to Montreal in the same capacity.

L. S. Strohl, assistant supervisor of track on the Panhandle division of the Pennsylvania, at Carnegie, Pa., has been appointed supervisor of track on the Indianapolis division, with headquarters at Columbus, Ind., succeeding **J. L. Tedesco,** who has been transferred to the Washington Terminal at Washington, D.C., where he replaces **L. R. Bailey,** who has been granted a leave of absence on account of illness. **L. A. Pelton,** assistant supervisor of track on the Maryland division at York, Pa., has been transferred to Carnegie, to replace Mr. Strohl. **R. D. Baldwin,** assistant on the engineering corps, Eastern region, with headquarters at Philadelphia, Pa., succeeds Mr. Pelton as assisant supervisor of track at York. **W. N. Taggart,** assistant supervisor of track on the Erie & Ashtabula division at Niles, Ohio, has been transferred to the Maryland division, with headquarters at Washington, D.C., succeeding **T. E. Ralston,** who has resigned. **W. B. Knight,** assistant on the engineering corps on the New York division, succeeds Mr. Taggart as assistant supervisor of track at Niles.

Bridge and Building

K. G. Nilsson, roadmaster on the Canandian National, with headquarters at Mirror, Alta., has been appointed bridge and building master, with headquarters at Calgary, Alta., succeeding **A. Crawford,** who has retired.

L. B. Britt, bridge and building foreman on the Atchison, Topeka & Santa Fe, at Winslow, Ariz., has been appointed acting general foreman, bridge and building—water service, with the same headquarters, relieving **D. E. Lewis,** who has been granted a leave of absence on account of illness.

Water Service

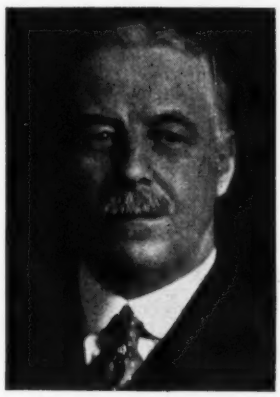
I. C. Brown, lead water inspector on the St. Louis-San Francisco, at Springfield, Mo., has been appointed water engineer, with the same headquarters.

Special

Neal D. Howard, editor of the *Railway Engineering & Maintenance,* and engineering editor of Railway Age, with headquarters at Chicago, has been appointed western editor of Railway Age, succeeding **Charles Layng,** who has relinquished that post for reasons of health, but retains a connection with the editorial staff. Mr. Howard retains his position as editor of *Railway Engineering and Maintenace,* but turns over his duties as engineering editor of Railway Age to **Merwin H. Dick,** managing editor of *Railway Engineering and Maintenance,* and western engineering editor of Railway Age, at Chicago. Mr. Dick continues as managing editor of *Maintenance.* The position of western engineering editor of Railway Age has been abolished. Photographs and biographical sketches of Messrs. Howard and Dick, and a sketch of Mr. Layng, were published in *Maintenance* for October, 1944, pages 950 and 952. **William H. Schmidt, Jr.,** who before the war was an associate editor in the New York office, has been named assistant western editor, with headquarters at Chicago.

Obituary

Richard H. Aishton, who retired in September, 1934, after 14 years as president, followed by one year as chairman of the board, of the American Railway Association, predecessor of the Association of American Railroads, died at his home in Evanston, Ill., on October 3. Prior to his election to the presidency

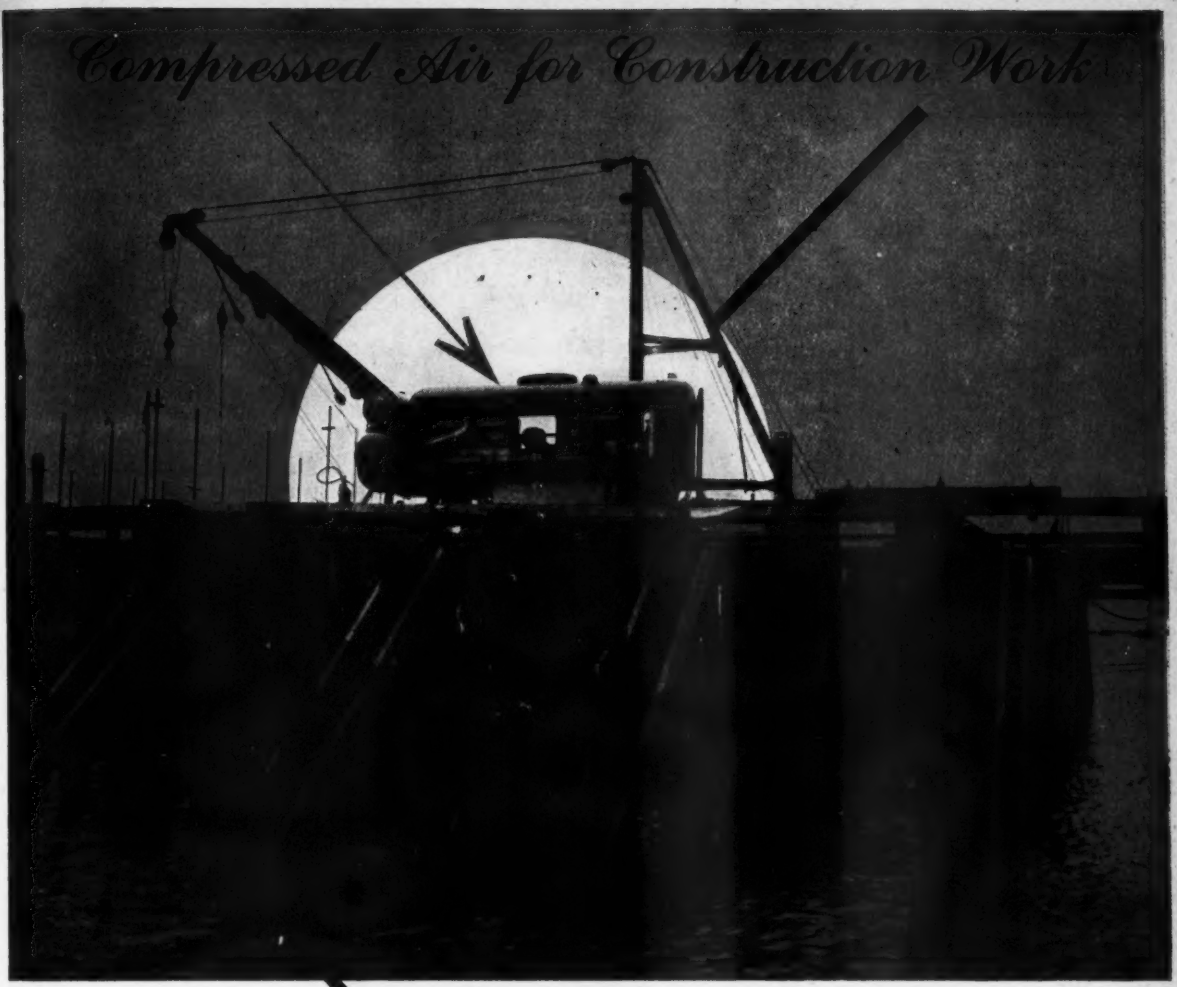


Richard H. Aishton

of the A. R. A. in 1919, Mr. Aishton had served as president of the Chicago & North Western and as regional director of the Western and Northwestern regions of the United States Railroad Administration during World War I.

Mr. Aishton was born in Evanston on June 2, 1860, and was educated in the public schools of that city. He entered railway service in 1878 as an axman in the engineering corps of the Chicago & North Western. Rising steadily through the ranks of the engineering and operating departments, he was advanced to assistant general manager in 1902, to general manager in 1906, and to vice-president in charge of operation in 1910. In 1916 he became president of the North Western, and served in that capacity until the beginning of federal control in 1918, when he became director of the Western region. When that region was divided into three regions, Mr. Aishton was made director of the Northwestern region. In 1919, when the American Railway Association was reorganized, Mr. Aishton was made president, and in 1920, when the A. R. A. was again reorganized, he became its chief executive. With the dissolution of the A. R. A. in September, 1934, Mr. Aishton retired.

(*Continued on page* 1224)



ANYWHERE

WITH SCHRAMM AIR COMPRESSORS!

Construction work indoors, outdoors, on land, on water . . . anywhere . . . Schramm Air Compressors are sturdy enough, compact and lightweight enough, to give you all the compressed air you want!

The construction field likes these Schramm features: 100% watercooled, permitting running with hood "on"; forced feed lubrication; mechanical intake valve; easy to move about on the job!

Schramm Compressors come in a complete range of sizes, to meet your needs. Write today for complete information on Schramm Compressors and Pneumatic Tools.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

Association News

Railway Tie Association

The 1947 convention of the Association will be held at the Arlington Hotel, Hot Springs, Ark., on September 23-25.

Roadmasters Association

President E. J. Brown has called a meeting of the Executive committee in Chicago on December 9 at the headquarters of the association at 431 South Dearborn street. The principal business of the meeting will be the selection of personnel of the technical committees to undertake studies and report at the 1947 convention.

Bridge and Building Association

The Executive committee, on the call of President F. G. Campbell, will meet at the headquarters of the association in Chicago at 431 South Dearborn street, on December 10, to transact routine business of the association and to select the personnel of the technical committee for the ensuing year.

Maintenance of Way Club of Chicago

More than 170 members and guests attended the first fall meeting of the club in its new headquarters, Harry Burke's restaurant in the Railway Exchange building, October 28. Following dinner, the feature of the meeting, which was presided over by President E. C. Vandenburgh, chief engineer, Chicago & North Western, was a paper by L. R. Lamport, engineer of maintenance, C. & N. W., on the installation of 27 assembled units of special trackwork in the North Western's crossing of the Milwaukee at Western avenue, Chicago. Mr. Lamport's remarks were followed by the showing of a motion picture of the complete sequence of the work, which was presented through the courtesy of the Ramapo-Ajax division, American Break Shoe Company. The next meeting of the club will be held at the same place on November 25.

Wood Preservers' Association

The Executive committee of the American Wood-Preservers' Association met at the Nicollet Hotel, Minneapolis, Minn., October 18, with R. H. Rawson, president, presiding. The primary purpose of the meeting was to begin preparation of the program for the 1947 annual meeting, which is to be held on April 22-24 at Multnomah hotel, Portland, Ore., and for the transaction of other association business.

American Railway Engineering Association

Meetings of the Board of Direction and of the Nominating committee are scheduled to be held at Chicago on November 19. Three standing committees have scheduled meetings for November, these including the Committee on Records and Accounts, which will meet at Cincinnati, Ohio, on November 21 and 22, the Committee on Co-Operative Relations with Universities, which will meet at Chicago on November 20, and the Committee on Track, which will meet at Chicago on November 25.

Eight committees held meetings during October, these including the Committees on Waterproofing, which met at New York on October 10 and 11; Water Service, Fire Protection and Sanitation, at Chicago, October 15; Wood Preservation, at Chicago, October 17; Economics of Railway Labor, at Chicago, October 18; Iron and Steel Structures, at Chicago, October 23 and 24; Rail, at Chicago, October 30; Ties, at Spartanburg, S. C., October 29, 30 and 31; and Buildings, at Buffalo, N. Y., October 31 and November 1.

Following their approval through letter ballot by the members, the new rail sections have also been approved by the General committee of the Engineering division, which has recommended to C. Hungerford, vice-president, operations and maintenance department, Association of American Railroads, that he approve the new sections.

Supply Trade News

Personal

S. S. Bruce, manager of the traffic and transportation department of **Koppers Company,** has been appointed to the newly-created position of executive sales representative in Washington, D. C., ef-

(*Continued on page* 1226)

BEALL Hi-Duty SPRING WASHERS

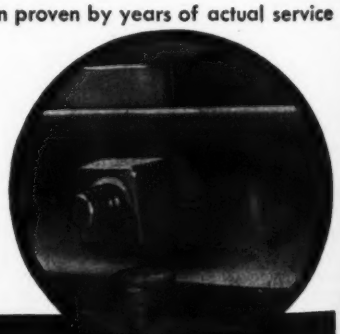
BEALL Hi-Duty SPRING WASHERS are made especially to stand the strain of the heavy-duty rail service required by today's high-speed freight and passenger trains.

We control every step of their manufacture — from the specification of the specially-developed formula and process used in making the steel to the forming, hardening, tempering and testing operations.

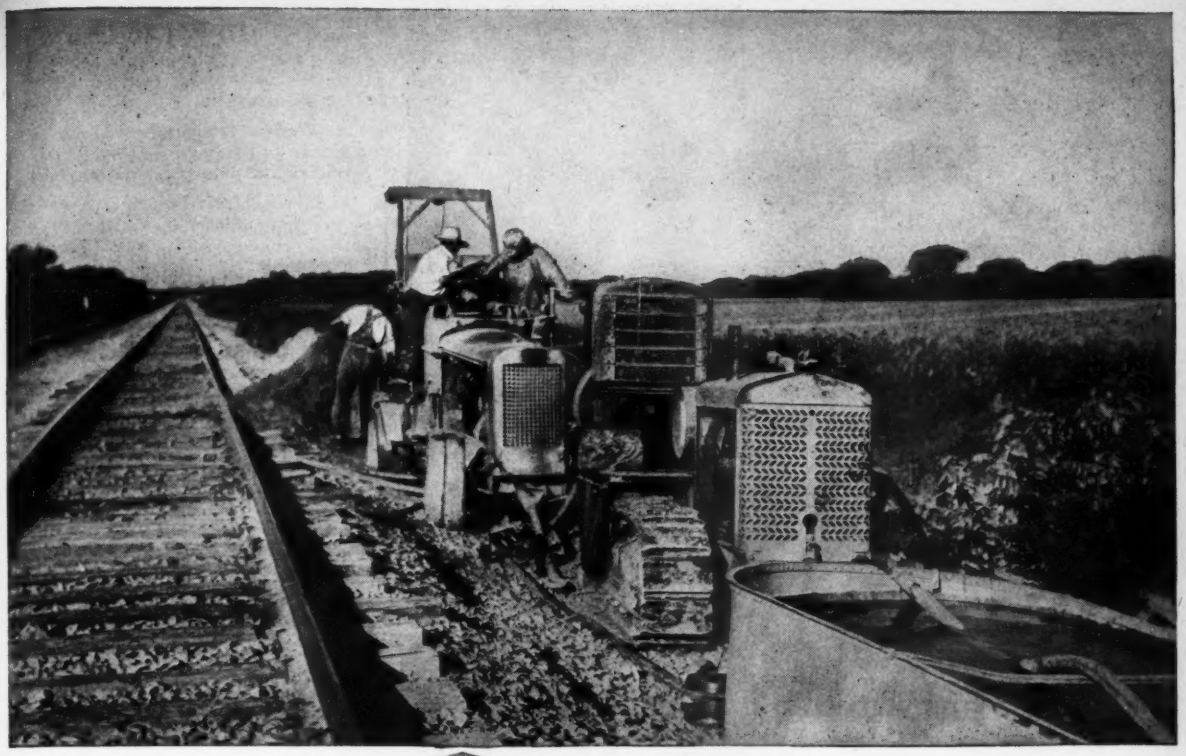
Their dependability has been proven by years of actual service on hundreds of railroads.

made especially for Railroad Service

BEALL HI-DUTY SPRING WASHERS, being made especially for railroad service are strong and tough, yet provide the necessary "springing action" required at rail joints, frogs and crossings.



BEALL TOOL DIVISION (HUBBARD & CO.)
140 Shamrock St., EAST ALTON, ILL.
SPECIALIST MANUFACTURERS OF SPRING WASHERS



THIS METHOD OF ROADBED STABILIZATION HAS SAVED UP TO 80% ON MAINTENANCE COSTS

ASPHALT-CEMENT pressure grouting—using *Texaco No. 24 Emulsified Asphalt*—has proved by actual experience to be the least expensive and most effective method of stabilizing roadbed. Even more important — its permanence greatly reduces track maintenance costs.

Savings made by one railroad are typical. *Maintenance costs after grouting were reduced up to 80% — and the initial cost of grouting averaged only about 65¢ a track foot!*

Texaco No. 24 Emulsified Asphalt was specially developed to promote easier flow of the grouting mixture, and to assure more complete penetration and seal. It expedites the work, permits use of leaner, more economical mixtures, helps waterproof the soil and keep it resilient and stable.

For complete information on asphalt-cement pressure grouting — methods, costs, results — call the nearest Railway Sales Division Office listed below, or write The Texas Company, *Railway Sales Division*, 135 East 42nd Street, New York 17, N. Y.

SEND FOR this fact-packed, 16-page, illustrated book. Describes the development of asphalt-cement pressure grouting, outlines a practical working set-up, shows costs and benefits secured by a leading railroad.

NEW YORK • CHICAGO • SAN FRANCISCO • ST. PAUL • ST. LOUIS • ATLANTA

TEXACO

TEXACO Emulsified Asphalt FOR GROUTING

Tune in . . . TEXACO STAR THEATRE presents the NEW EDDIE BRACKEN SHOW every Sunday night. See newspapers for time and station.

Mercury Chooses INLAND 4-WAY FLOOR PLATE for "The Trackless Train"

In an effort to build smart design as well as safety into their product—"The Trackless Train"—Mercury Mfg. Co., Chicago, uses Inland 4-Way Floor Plate for critical points where slips or falls might occur.

Its structural strength permits installation not "over" but "in place of" other material for floor board, steps and back platform.

For plant or product application, Inland 4-Way Floor Plate offers many advantages for floors, steps, ramps, walkways, platforms, hatch covers or any place where foot or wheel must have safe, positive traction.

Because it is steel—the strongest flooring you can use—Inland Safety Floor Plate is fireproof, rotproof, cannot warp, splinter, crack or absorb liquids and odors—available from leading steel warehouse distributors. Write for catalog.

INLAND STEEL COMPANY
38 S. Dearborn Street Chicago 3, Ill.
Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

(*Continued from page* 1224)

fective November 1. **John B. Keeler,** assistant manager of the traffic and transportation department, will succeed Mr. Bruce as manager.

A. Watson Armour has been elected chairman of the board of directors of the **National Aluminate Corporation.**

A. P. Lerch has been appointed chief tool design engineer of the **Hyster Company,** Portland, Ore.

J. E. Hickman has been assigned to the New York export office of the **Byron Jackson Company.**

Willard G. Hartman has been elected president, general manager and director of the **Lewis Bolt & Nut Co.,** at Minneapolis, Minn.

S. J. Beatty, Jr., has been appointed assistant sales manager in charge of the Gradall Division of the **Warner & Swasey Co.,** Cleveland, Ohio.

Milton B. Steinmetz, manager of railroad sales for the **Snap-On-Tools Corporation,** Kenosha, Wis., has been appointed industrial sales manager, a newly-created position.

James D. Greensward, who has been associated with the **Allis-Chalmers Manufacturing Company,** Milwaukee, Wis., since 1922, has been appointed assistant to William C. Johnson, vice-president of the general machinery division.

Skilsaw, Inc., Chicago, has announced the purchase of the **Forss Pneumatic Tool Company,** Aurora, Ill. **F. P. Forss** and his son **John Forss** will remain with the Skilsaw organization and will be in charge of pneumatic tool manufacturing operations at the Aurora plant.

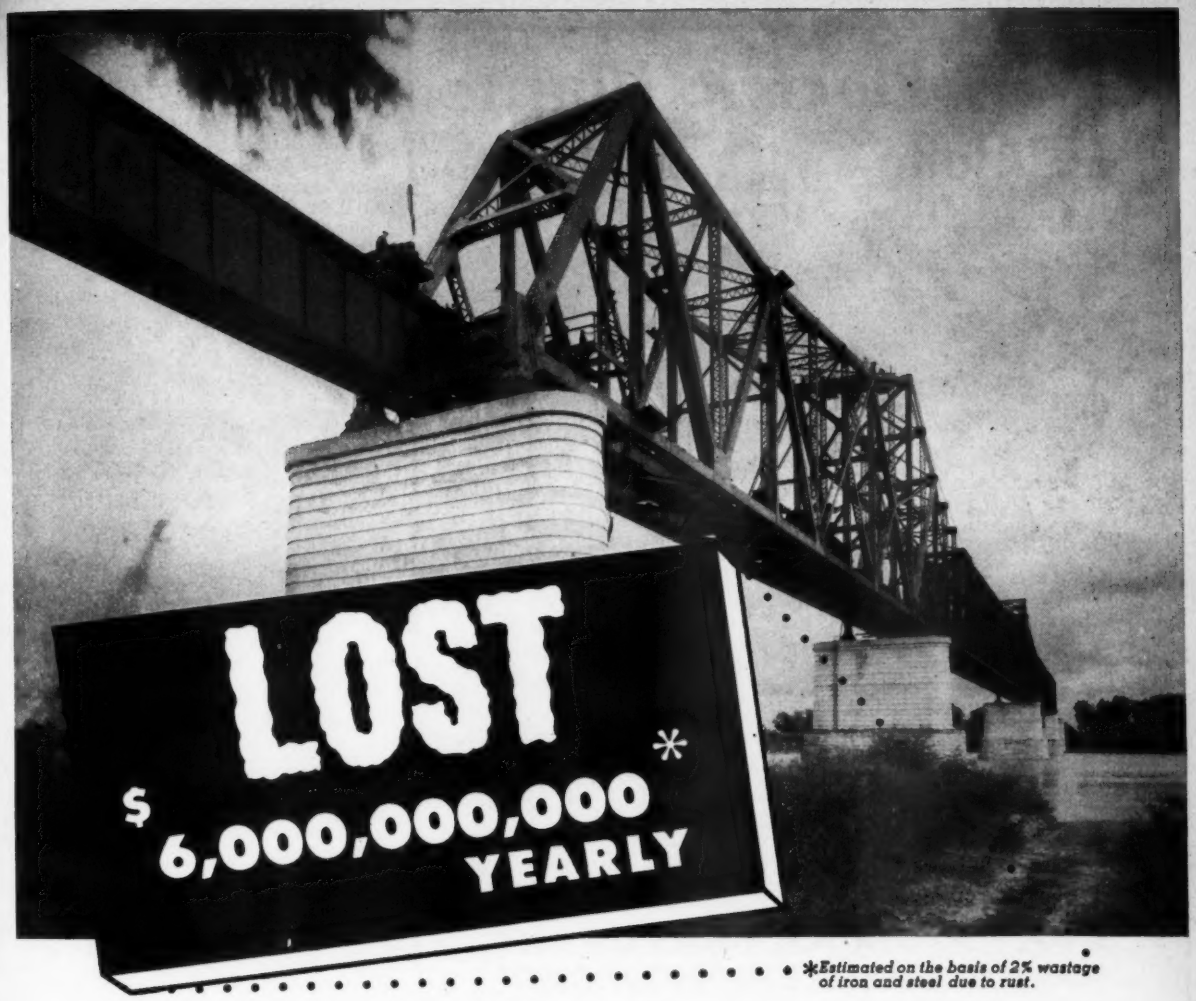
Frank P. Smith has been appointed sales engineer in the Cleveland, Ohio, region for **E. I. du Pont de Nemours & Co.,** with headquarters in Pittsburgh, Pa. Mr. Smith will serve the clientele formerly served by W. J. Bradley for the Du Pont finishes division.

William A. McFarland, chemical research engineer for the **American Lumber & Treating Co.,** will be in charge of a new laboratory to be opened on November 1 at the firm's Wauna, Ore., plant, the purpose of which is to place research in close contact with the treatment of Douglas fir and other western species.

James R. Reed has been appointed manager of the commercial research department of the **Allis-Chalmers Mfg. Co.,** Milwaukee, Wis. **Jerome F. Fitzsimmons** has been appointed supervisor in charge of research. **Anson J. Bennett, Jr.,** has been appointed supervisor in charge of sales analysis.

M. T. Herreid, vice-president of the **Koppers Co. Inc.,** at Pittsburgh, Pa., has been appointed manager of the Koppers plants at Granite City, Ill., and St. Paul, Minn., with headquarters at St. Paul. **J. F. Byrne,** vice-president, has been appointed on special assignment for the engineering and construction division, with headquarters at New York. **Stanley N. Brown,** vice-president, becomes manager of the

(*Continued on page* 1228)



*Estimated on the basis of 2% wastage of iron and steel due to rust.

You pay a share of this tremendous loss, if you fail to protect iron and steel surfaces from the metal-consuming "fire" of rust.

RUST-OLEUM STOPS RUST!

For less than a cent per square foot material cost, you can add years of life to bridges, signal equipment, water tanks, rolling stock and other property. RUST-OLEUM will positively stop and prevent rust. It penetrates surface rust and incorporates it within the protective film—a water-tight, air-proof, rust-inhibiting coating that does not crack, blister or peel.

EASY TO USE . . .
LASTING PROTECTION

APPLY BY BRUSH, DIP OR SPRAY

RUST-OLEUM SAVES LABOR 3-Ways!

1. IT Cuts Preparation Time!
No sandblasting or chemical cleaners are necessary. Wirebrushing removes paint scale or blisters, dirt, etc.

2. IT Goes On Faster!
Rust-Oleum saves 25% of the time ordinarily required for the application and covers 30% more area than ordinary material—*an important saving.*

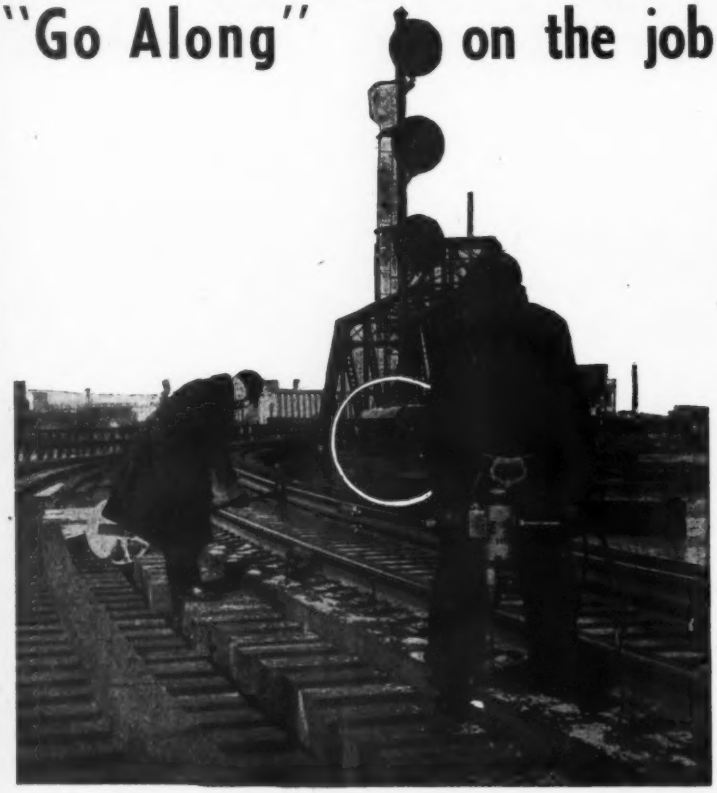
3. IT Lasts Longer!
As a protective coating, Rust-Oleum outlasts paint two to ten times on most jobs. This means *extra* savings.

Get the facts—NOW! Write today for Catalog No. 145 for recommended applications.

RUST-OLEUM CORPORATION

2415 Oakton Street • Evanston, Illinois

Onan Electric Plants
"Go Along" on the job



SUPPLY POWER FOR TOOLS ON ANY MAINTENANCE OR BUILDING PROJECT

ONAN Electric Plants are available in many sizes and models.
ALTERNATING CURRENT: 350 to 35,000 watts in all standard voltages and frequencies.
DIRECT CURRENT: 600 to 10,000 watts, 115 and 230 volts.
BATTERY CHARGERS: 500 to 3,500 watts; 6, 12, 24, and 32 volts.

High on a trestle or deep in a tunnel, Onan Electric Power is always ready—always dependable. Save time and labor by using drills, hammers, saws, pumps and other motor-driven tools anywhere!

Ranging from small, portable 350-watt models to 35,000-watt, heavy-duty units, there's an Onan plant to fit any application in the railroad industry.

Powered by sturdy, 4-cycle, gasoline engines, Onan plants are compact, rugged, economical to operate and maintain. Onan generators are direct-connected for permanent alignment.

Write for special folder.

D. W. ONAN & SONS INC.
4420 Royalston Ave., Minneapolis 5, Minn.

TYPICAL RAILROAD USES OF ONAN POWER PLANTS
Charge batteries. Supply power for maintenance tools. Furnish light for construction jobs. Power radio communication equipment.

POWER & LIGHT FOR EVERY NEED
Onan
ELECTRIC PLANTS

REPRESENTATIVES IN ALL PRINCIPAL CITIES

(*Continued from page* 1226)

new finance department. **J. N. Forker,** vice-president, becomes general manager of the new tar products division. **Dan M. Rugg,** vice-president, becomes general manager of the new chemical division. **W. Reed Morris,** vice-president, becomes general manager of the new gas and coke division. **George M. Walker** has been appointed manager of the new control section.

J. F. Weiffenbach has been appointed chief engineer of the railroad division of **Fairbanks, Morse & Co.,** with headquarters at Chicago. Mr. Weiffenbach was born on November 20, 1910, at Chicago, and received his higher education at the

J. F. Weiffenbach

University of Michigan, from which he was graduated in 1934 with a degree in mechanical engineering. In that year he joined the Electro-Motive division of the General Motors Corporation, and prior to his recent appointment he had served continuously with that firm, doing locomotive engineering and designing.

R. W. Lea, vice-president of finance since 1939 for the **Johns-Manville Corporation,** has been elected president to succeed **Lewis H. Brown,** who was elected chairman of the board and chief executive officer. **Alvin Brown** was elected a director and vice-president for finance, and **John P. Syme** was elected vice-president and assistant to the chairman.

The following appointments as general managers of the six new operating divisions into which the company has been reorganized were announced: **J. A. O'Brien,** industrial products division; **Harold R. Berlin,** building products division; **A. S. Elsenbast,** Celite division; and **E. C. Brockett,** Canadian products division. **A. F. Fisher,** vice-president for production, will act as general manager of the asbestos fiber division, and **E. S. Crosby** will continue as general manager of the international division. **R. H. Beight** has been appointed district engineer at Fort Worth, Tex., where representation has been recently restored. **Mariano A. Montero** has been appointed district engineer of a newly created district to serve Mexican railroads, with headquarters at San Luis Potosi, Mex. He will be assisted by **Fred M. Smith,** service engineer, formerly of the La Grange (Ill.) plant.

(*Continued on page* 1230)

NO WAITING

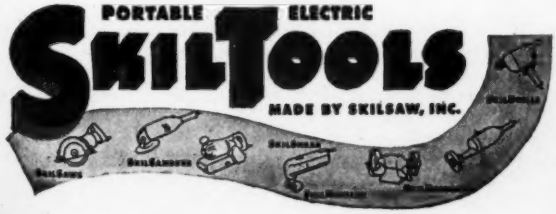
for Pneumatic SKILSAWS!

CUT 4⅜ IN. DEEP IN WOOD

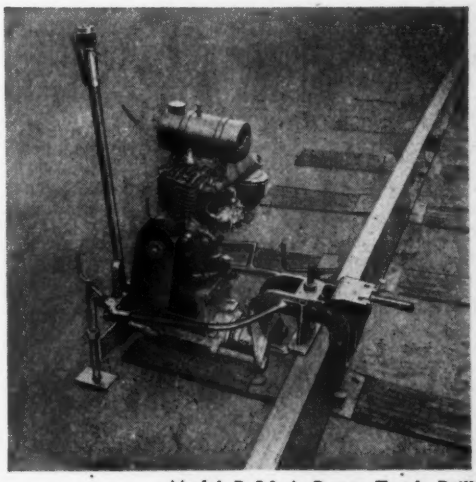
● Your distributor can supply you now with these powerful *pneumatic* SKILSAWS that cut 4 x 8's fast . . . 8 x 16's in 2 quick cuts. Operate on any 80-100 lb. air pressure line. Require only 50-55 cu. ft. of free air per minute under normal load. Give you outstanding safety features including leakproof throttle valve that cuts off air instantly when closed . . . positive safety lock that prevents accidental starting . . . automatic telescoping guard that shields the saw blade. Ask your distributor today for a demonstration of *pneumatic* SKILSAW!

SKILSAW, INC.
5033-43 Elston Ave., Chicago 30, Ill.
Factory Branches in All Principal Cities

PORTABLE ELECTRIC
SKILTOOLS
MADE BY SKILSAW, INC.



A new RTW *power track drill*



Model P-34-A Power Track Drill

Modern in design, up-to-date in construction, this new track drill embodies many features that help speed rail maintenance at materially reduced costs.

The P-34-A consists of a 1½ hp air-cooled gasoline engine, with V-Belt drive from the engine shaft to a counter shaft which drives drill through a gear reduction assembly.

Gear reduction housing is cast aluminum to reduce weight. Steel frame, of lasting strength and durability, is designed to provide fast, accurate leveling with rail and irregular or uneven ground. There is also ample adjustment to various rail sizes.

For easy operation, lateral travel for feeding drill is controlled by a ratchet gear and rack. The chuck will take a flat beaded bit up to 1½ inches and will drill a hole in less than a minute.

Belt is adjusted by raising or lowering motor on frame. Guards are installed for protection around frame.

Well balanced, light weight, portable, quick to attach and remove from rail, the P-34-A Power Track Drill is designed for durability, easy handling and to insure efficient rail maintenance.

Further information on the P-34-A and other RTW machines sent on request.

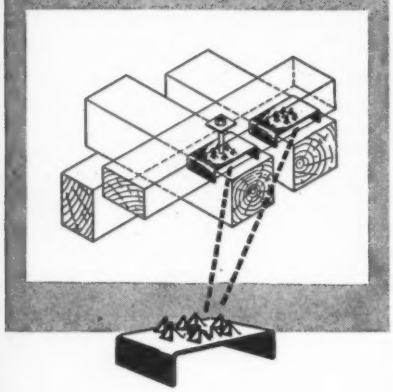
Railway Track-work Co.
3207 KENSINGTON AVE., PHILADELPHIA 34, PA.

2076

TECO

CLAMPING PLATES

tie 'em down



Use TECO clamping plate timber connectors for rigidly attaching ties to guard timbers with low maintenance cost.

Bolts are used in every third or fourth tie with lower replacement costs.

Write for FREE design data for using clamping plates.

TIMBER ENGINEERING COMPANY
1319 18th St., Washington 6, D. C.

Please mail me free design data for using Teco Clamping Plates.

Name.....

Company.....

City.....

State.....

REM

(*Continued from page* 1228)

Gerald C. Smith has been appointed district engineer of the Denver service headquarters now under the jurisdiction of the St. Louis region, succeeding **W. E. Dunn,** who has been appointed regional service manager of the Chicago region.

James G. Graham has been appointed district manager of the railroad division of **Fairbanks, Morse & Co.,** with headquarters at Chicago. Mr. Graham received his higher education at Ohio State University and Drexel Institute, after which

James G. Graham

he joined the J. G. Brill Company at Pittsburgh, Pa. From 1928 to 1932, he held a position in the operating department of the Baltimore & Ohio, and in the latter year he joined the New York Central as a general agent in the road's freight department. In 1938 he entered the employ of the Oliver Iron & Steel Corp., at Pittsburgh, as general manager of railroad sales, which position he held prior to his recent appointment.

H. R. McLaren has been appointed assistant general superintendent of the **Timken Roller Bearing Company,** Canton, Ohio. **J. P. Wargo** has been appointed superintendent of tube mills, and **R. R. Elsasser,** assistant superintendent of tube mills.

J. C. Lungerhausen has been appointed chief development engineer of the industrial pump division of **Bowser, Inc.,** Fort Wayne, Ind. For the past five years he has been development engineer for the Blackmer Pump Company, Grand Rapids, Mich.

J. A. Hill, manager of the New York office of the **Independent Pneumatic Tool Company,** Chicago, has been appointed manager of electric tool sales, with headquarters at Chicago. **W. C. Rush,** sales and service engineer at St. Louis, Mo., has been appointed manager of the company's branch at Pittsburgh, Pa. **H. C. Brown** becomes manager of the new branch office at 426-428 Elm Street, Cincinnati, Ohio.

Wesley N. Gordon has been appointed manager of the alloy sales division in the general sales department of the **United States Steel Supply Company,** a subsidiary of the United States Steel Corporation. Mr. Gordon, who is a graduate of Virginia Polytechnic Institute, will have jurisdiction over alloy sales in Boston, Mass., Newark, N.J., Baltimore, Md., Pittsburgh, Pa., Cleveland, Ohio, St. Paul, Minn., Milwaukee, Wis., and Chicago. His headquarters will be in Chicago.

G. V. Leece, vice-president of the **Gardner-Denver Company,** has been appointed general sales manager for the company. Mr. Leece, who is also a director, will have his headquarters at the company's plant at Quincy, Ill.

Charles E. Conlin, formerly in charge of weed control on the Southern Pacific, has been appointed head of the **California Spray-Chemical Corporation's** new railroad weed control service, with headquarters at the Richmond, Cal., plant.

Russell F. Oakes, formerly chief, Office of Technical Information, Office of the Chief of Transportation, United States Army, has been appointed executive assistant to the vice-president of the **Clark Equipment Company** and general manager of the Clark Tructractor division.

E. A. Foster has been appointed manager of the application engineering department of the railroad division of **Fairbanks, Morse & Co.,** with headquarters at Chicago. Mr. Foster was graduated from the University of Illinois in 1927, with a degree in railway electrical engineering. Following graduation, he became a test engineer of rolling stock for the Chicago Surface Lines, and in 1930 he became

E. A. Foster

associated with Sperry Products, Inc., at Hoboken, N. J. In 1936 Mr. Foster joined the Electro-Motive division of the General Motors Corporation, and for the past 10 years has been associated with various departments of that firm.

Obituary

A. Elton Holcomb, formerly division sales manager for the Koehring Company, Milwaukee, Wis., died on October 5 at Indianapolis, Ind. Educated at the University of Michigan, and widely known in the power shovel and crane industry, Mr. Holcomb was a past president of the Milwaukee chapter of the American Association of Engineers, and a member of the American Association of Civil Engineers, the American Society of Mechanical Engineers, and the American Society of Military Engineers.

SYNTRON

Gasoline Hammer

PAVING BREAKERS and SPIKE DRIVERS

100% Self-Contained

Heavy-duty "off-the-track" tools that will save your crews a lot of time—and save you money.
Entirely self-contained, they do not require auxiliary power equipment.
Bust concrete—drive spikes—dig clay and shale quickly and easily.

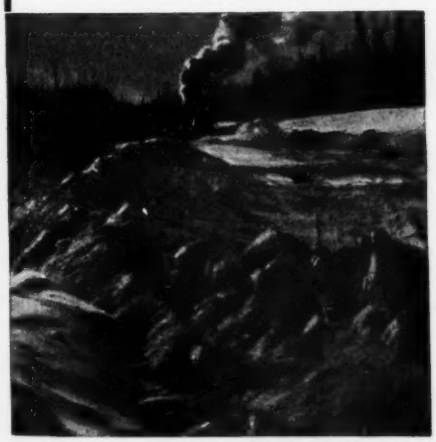
Write for illustrated folder

SYNTRON CO., 290 Lexington, Homer City, Pa.

Hampered by snow-blockades?—SEND THE JORDAN

Snow-bound track and the Jordan Snow Plow can't get along together—and the snow loses.

Is it drift-filled cuts?—the Jordan has no superior at bucking them clear.



If it's snow-bound yards, the Jordan's huge wings clear two and three tracks at once. For ordinary snow moving, the Jordan Standard Type does the job. In the deep-snow country, the Jordan Type A is called for.

It's an indispensable all-year maintenance tool—in dry weather keeps road bed well drained, easier to maintain.

Write for the Jordan Book on your business letterhead

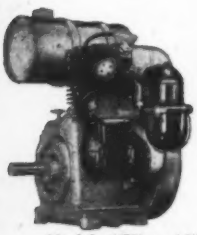
O. F. JORDAN COMPANY

WALTER J. RILEY, *President*

EAST CHICAGO, INDIANA

Multiply the PRODUCTIVE CAPACITY *of* MEN *and* EQUIPMENT with WISCONSIN HEAVY-DUTY *Air-Cooled* ENGINE POWER . . .

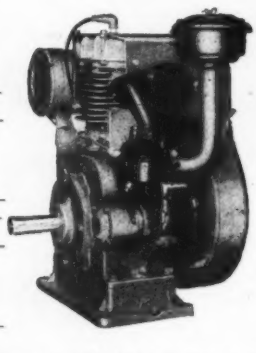
During these difficult days of equipment shortages and overburdened railway operating and maintenance schedules, Wisconsin Heavy-Duty Air-Cooled Engines . . . and all types of Wisconsin-powered auxiliary equipment . . . rate top preference among men who place a premium on "productive capacity". There is no substitute for heavy-duty dependability and hard-slugging serviceability.



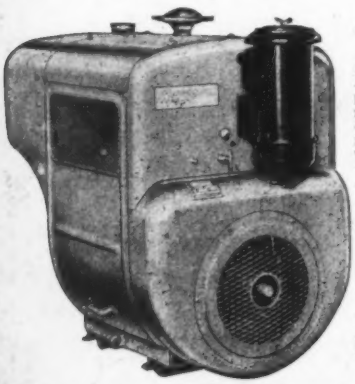
Model AB, AK Series
4-cycle, single cylinder

SPECIFICATIONS:	AB	AK
Bore	2½"	2⅞"
Stroke	2¾"	2¾"
Cu. In. Displ.	13.5	17.8
Hp. Range	2-3	3-4
Weight	76 lbs.	77 lbs.

Models AEH to AHH Series
4-cycle, single cylinder



SPECIFICATIONS:	AEH	AFH	AGH	AHH
Bore	3"	3¼"	3½"	3⅝"
Stroke	3¼"	4"	4"	4"
Cu. In. Displ.	23	38.2	38.5	41.3
Hp. Range	4-6	5-7	6-8.5	7-9
Weight	130 lbs.	170 lbs.	175 lbs.	180 lbs.



Models VE4 to VP4 Series
4-cylinder, V-type

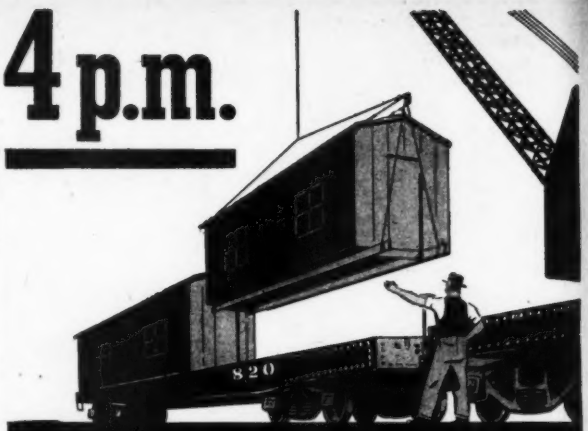
SPECIFICATIONS:	VE-4	VM-4	VP-4
Bore	3"	3¼"	3½"
Stroke	3¼"	4"	4"
Cu. In. Displ.	91.9	132.7	154
Hp. Range	13-22	20-28	23-31
Weight	295 lbs.	418 lbs.	418 lbs.

Let us put you in touch with the nearest Wisconsin Engine distributor and write for detailed data.

Most H.P. per pound

WISCONSIN MOTOR Corporation
MILWAUKEE 14 WISCONSIN U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines

4 p.m.



Two 9'-4"x20' standard STEELOX buildings, used as bunk houses, are hoisted by a railroad crane onto a waiting flat car.

6 p.m.

Two hours later, ten miles away, the section gang "beds up" for the night at a new location. It was not even necessary to adjust the temporary timber foundations.

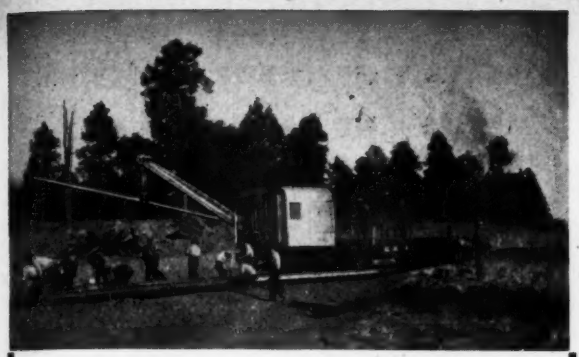
This actual "case history" illustrates the easy portability of standard ARMCO STEELOX Buildings in railroad uses. Buildings can be moved this way, or can be taken down in sections and re-assembled in another location in less than a day.

Standard STEELOX Buildings have still other advantages. These modern, trim-looking structures brighten up the right-of-way. The galvanized PAINTGRIP surface of STEELOX can be painted in your standard colors before the construction gang leaves. This mill-Bonderized treatment on galvanized steel also assures long paint life.

STEELOX Buildings are fire-resistant. Interlocking joints keep out dust and vermin. They can be quickly wired, easily insulated, or may be left uninsulated without affecting weather-tightness. Write for prices and complete details. Armco Drainage & Metal Products, Inc., and Associated Companies, 3515 Curtis Street, Middletown, Ohio.

ARMCO

STEELOX BUILDINGS



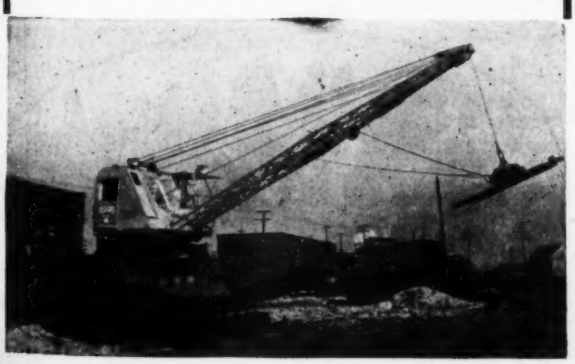
ANY JOB— ANYWHERE

With bucket, hook, magnet, dragline or rail tongs, the Burro is ready to handle any job—anywhere. Burro's fast travel speeds permit it to get out on the job without delay—in addition, heavy draw bar pull permits Burro to haul its own work gang or cars of equipment, often eliminating need for a work train or locomotive. Designed for railroad work—and built to stand the punishment of hard, year after year use on any job, anywhere they are needed, Burro cranes are the busiest machines on the railroad. Only Burros have all these features:

- **Fast Travel speeds**—Draw Bar Pull up to 7500 lbs.
- **Elevated Boom Heels**—for working over high sided gondolas
- **Low overall height**—Burro can be moved and worked on a standard 46 foot flat car
- **Short Tail Swing**—increases crane operation—will not foul adjoining track
- **Wide operating range**—can be used with clamshell bucket, rail tongs, hook, magnet or dragline

CULLEN-FRIESTEDT CO.

1301 S. Kilbourn Ave. Chicago 23, Ill.



This Is MARION, INDIANA

Another 100% Layne City

—Marion, a busy, progressive and forward looking city of east central Indiana gets its entire water supply from Layne Well Water Systems. And taking a tip from the city are a brewery, a food processing plant, a radio and television station, two meat packers, a military home, a wire and rubber manufacturer, a glass company, a laundry and a wire and cable company—all of whom have their own individual Layne Water System plants.

—Seldom does an industrial product enjoy such dominating preference as is accorded to Layne Well Water Systems by Marion City and Factory executives. Such preference was earned through recognized reputation of superior quality and basically sound operation economy.

—Layne Well Water Systems are known to be the best that specialized engineering research can produce—and the best that American dollars can buy. For late catalogs and illustrated literature, address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine Pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves on power cost.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Pacific, Inc., Seattle, Wash. * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

REDUCE...

Track Maintenance Time and Cost

with a Mall REG. U.S. PAT. OFF. PORTABLE RAIL GRINDER

★ *Off-The-Track*
★ *Easily Portable*
★ *Efficient*
★ *Safe*
★ *Economical*

You can reduce wear and tear on rolling stock, reduce road bed maintenance and increase rail life with this powerful light weight, off-the-track 6 H.P. Mall Rail Grinder. The variable speed gasoline engine provides abundant power for smoothing off rail joint welds, grinding frogs, switch points and crossings.

Attachments, quickly interchangeable with grinding wheels, can be furnished for drilling rails, ties and crossing planks, drilling holes for lag screws, wire brushing and other jobs. The patented slip lock detail on ends of heavy duty flexible shafting and on various attachments speeds up tool changing. Ruggedly constructed to stand up under hard continuous use. Pneumatic wheel makes for easy rolling. This unit will quickly repay its original cost in lower maintenance and grinding costs.

Other MALL Portable Power Tools include Cross Slotters, Gasoline Engine, Pneumatic and Electric Concrete Vibrators and Surfacers, Gasoline Engine and Pneumatic Chain Saws, Electric Circular Saws, Electric Drills, Flexible Shaft Machines with attachments for sanding, grinding, polishing, wire brushing, buffing and drilling.

Write for literature and prices.

Railroad Department

MALL TOOL COMPANY

7746 South Chicago Ave. Chicago 19, Ill.

★ 25 Years of "Better Tools For Better Work."

Mall REG. U.S. PAT. OFF. PORTABLE POWER TOOLS

Leading railroads combat snow and ice inexpensively ... use Sterling Rock Salt *whenever treacherous ice forms*—

1. **On Station Platforms, Stairs, Drives, Walks**
2. **On Car Platforms, Steps**
3. **In Track-Heave Areas**
4. **On Switches, Flange Ways**
5. **With Coal in Cars**
6. **In Ash Pits, Engine Hoppers**
7. **In Freight Yards**

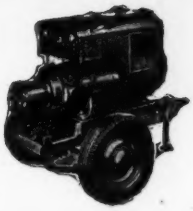
Sterling "Auger-Action" Rock Salt is the relentless enemy of winter ice and snow. It cuts railroad operating costs, reduces accident hazards, speeds use of equipment, safeguards passengers, prevents damage to equipment. Write today for free consultation with an International field engineer on how, where, and when to use Sterling Rock Salt.

INTERNATIONAL SALT COMPANY, INC., SCRANTON, PA.

MASTER COST-SAVING EQUIPMENT—FOR IMMEDIATE DELIVERY

CLIP THIS ADVERTISEMENT—CHECK CATALOGS WANTED

Electric Tie Tampers and Gas Backfill Tampers (Catalog No. 699)



Portable Gas-Electric Generator Plants. Sizes 500 to 17,000 Watts (Catalog Number 594)

Gas or Electric Grinding Machines and Power Tools (Catalog No. 683)

BIG-3 for Generation, Tool Operation and Concrete Vibration (Catalog No. 687)

General Purpose Floodlights

You can count on the Master Equipment illustrated here to solve your most difficult construction and maintenance problems. Shown are: Master Tie Tampers, Backfill Tampers, Portable Gas-Electric Generator Plants, Grinding Machines and Hand Tools—each designed to save you time and money.

Other available Master Equipment not illustrated includes: "Power Blow" Electric Hammers and Electric Pavement Breakers.

Watch for announcements of additional Master Equipment now in the making, and meanwhile let Master Equipment help you do a better job—faster and more economically.

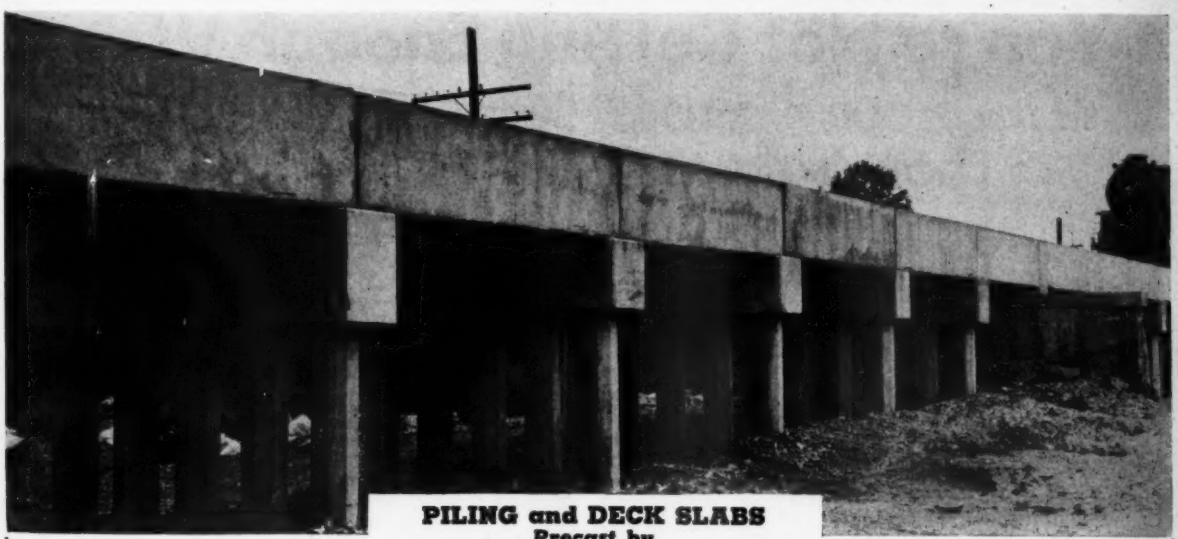
Hand Tools for use with BIG-3 and Grinding Machines (Catalog No. 687)

CLIP THIS ADVERTISEMENT—CHECK CATALOGS WANTED

Send for illustrated catalog on any item to

MASTER VIBRATOR COMPANY

DAYTON 1, OHIO



PILING and DECK SLABS
Precast by

MASSEY

CONCRETE PRODUCTS CO.

122 S. Michigan Ave.
Chicago 3

Sales Offices

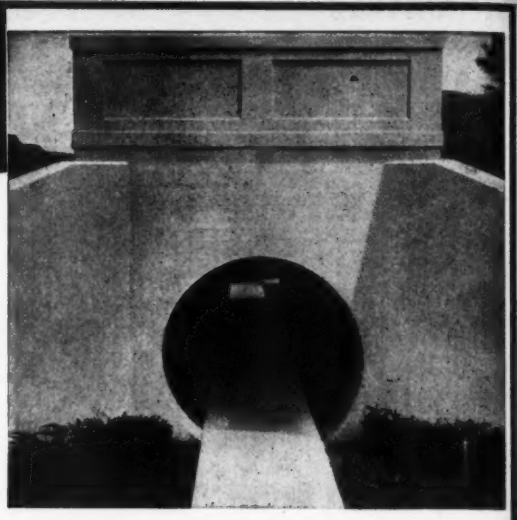
New York, 50 Church St.
Atlanta, 1607 Chandler Bldg.
Minneapolis, 2429 Broadway, N.E.

Plants

Chicago, Ill. Minneapolis, Minn.
Kansas City, Kans. Melbourne, Ky.
New Brunswick, N.J. Birmingham, Ala.

Culvert Pipe—Cribbing—Relay Houses—Crossing Slabs
Signal Foundations—Battery Wells and Boxes

FOR UNDERPASSES LIKE THIS



Use UNIVERSAL REINFORCED CONCRETE PIPE

Universal reinforced concrete pipe provides adequate strength, durability and economy in the construction of pedestrian underpasses.

Universal pipe can be jacked through a fill, such as shown in the photo above, at the rate of more than one foot an hour. In other words, the underpass illustrated, 69′ of 96″ pipe, was completed in 8 days.

Universal concrete pipe is available in stock sizes to 144″.

Send for pamphlet describing jacking of reinforced concrete pipe.

Buy the Best—

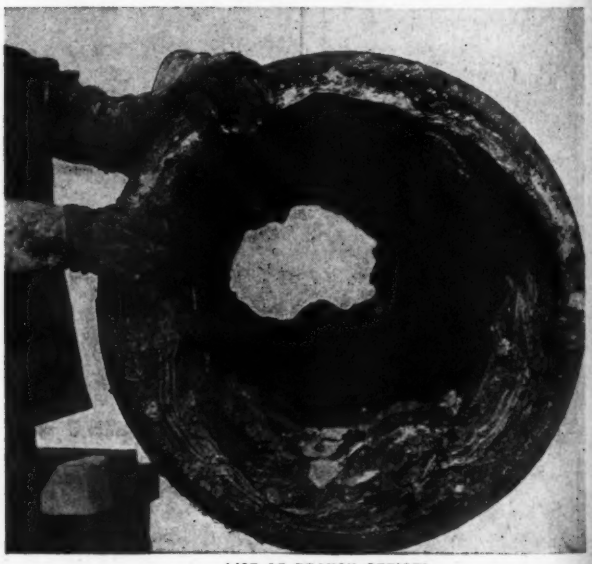
UNIVERSAL CONCRETE PIPE CO.

For Permanence

297 S. High St. Columbus 15, Ohio

If You're Not Getting Enough Water-

Maybe YOUR MAINS LOOK LIKE THIS—



let **NATIONAL** *restore them to 95% capacity*

Keep the water capacity and pressure you planned when your mains were built by periodically using National service. Our special machines quickly remove hard encrustations in any kind or size of pipe, even when diameters vary, with little interruption to normal service. A National engineer near you can be most helpful with expert advice born of 40 years of service to railroads, industries, and municipalities.

NATIONAL WATER MAIN CLEANING CO.

50 CHURCH ST. NEW YORK 7, N. Y.

LIST OF BRANCH OFFICES

1221 Mortgage Guarantee Bldg. Atlanta 3, Ga.

115 Peterboro Street Boston 15, Mass.

205 West Wacker Drive Chicago 6, Ill.

421 B.M.A. Building Kansas City 8, Mo.

519 Farnsworth Bldg. Memphis 3, Tenn.

2028 Union Ave. Montreal 2, Canada

3812 Castellar St. Omaha 5, Neb.

210 East Franklin St. Richmond 19, Va.

681 Market St. San Francisco 5, Calif.

The Rohan Co., Inc. P. O. Box 887 Waco, Texas

576 Wall Street Winnipeg, Manitoba, Canada

Americo Rodriguez, Inc. P. O. Box 749 Mayaguez, Puerto Rico

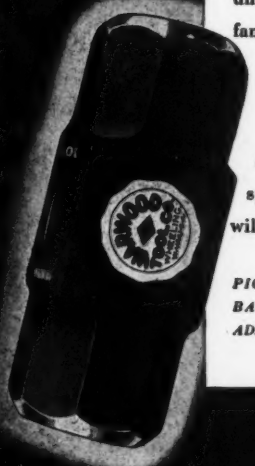
WARWOOD WORKMANSHIP
MAKES THE DIFFERENCE

WARWOOD
TRACK
TOOLS

Track Chisel
NO. 1

Correctly designed, accurately forged and with a uniformly high quality maintained throughout the entire line, Warwood Track Tools are the kind that stand up under severe service. These famous tools are scientifically heat treated to meet A. R. E. A. specifications and when you specify Warwood . . . you specify Track Tools that will meet your requirements.

PICKS...MAULS...WRENCHES
BARS....TONGS....SLEDGES
ADZES... PUNCHES... CHISELS

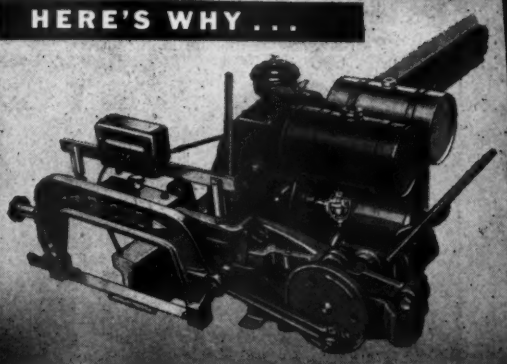


WARWOOD
SINCE 1854
FORGED TOOLS

Double Faced Sledge
NO. 13-T

WARWOOD TOOL COMPANY
WHEELING, WEST VIRGINIA

HERE'S WHY . . .



Many Railroads Prefer
RACINE
High Speed Portable
RAIL SAWS

1 *They cut rails faster than any other method* — An 80 lb. rail in 5 min., 100 lb. rail in 7 min., 130 lb. in 9 min. Standard capacity for rails up to 7⅛" x 6½". Extra capacity 10" x 6½" for special Trilby rails.

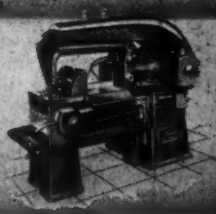
2 *They do a more accurate job* — As little as 3/10" can be cut from end of rail. Cutting results in a smooth rail face that requires no additional work.

3 *They save time and labor* — Two men can easily transport and only one man needed to operate saw. No need for heavy "on track" equipment — no traffic delays because of rail cutting.

4 *They do a better cutting job* — No chipping, overheating or burning of grain structure. No split ends.

Racine Rail Saws are today standard maintenance equipment in the yards and shops of many leading railroads. Models are available for operation with gasoline, electric and compressed air power. Write for descriptive [illegible] details.

RACINE METAL SAWS FOR SMALL AND LARGE SHOPS
Investigate Racine's complete line of hydraulic metal cutting saws — with simple one lever control for all operating phases . . . for fast, accurate cutting of any metal. In capacities 6"x6" to 20"x20". Ask for Catalog No. 12. RACINE TOOL AND MACHINE COMPANY, 1738 State St., Racine, Wis.

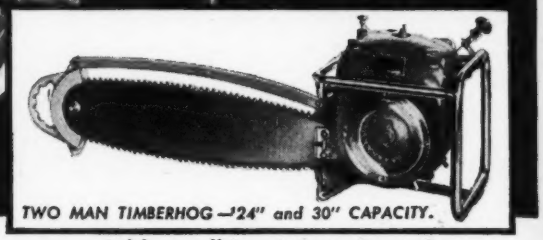


RACINE

RACINE

SPEED YOUR TIMBER FELLING and BUCKING . . . with "TIMBERHOGS"

ONE MAN TIMBERHOG SAW — 20" CAPACITY.



TWO MAN TIMBERHOG — 24" and 30" CAPACITY.

One minute — to notch and fell a 14" hard oak tree with the Reed-Prentice Timberhog gasoline powered chain saw! Lightweight 4 h.p. engine!

Models in 20", 24" and 30" capacities, sturdy construction, trouble free service with minimum maintenance! Available now — 20" one man saw, 52 lbs., $325.00; 24" two man saw, 54 lbs., $335.00; 30" two man saw, 57 lbs., $345.00 f.o.b. factory. Write for name of nearest distributor.

Address all inquiries to Dept. R
TIMBERHOG SAW DIVISION

"TIMBERHOG" REED-PRENTICE CORP. WORCESTER SAWS MASS., U.S.A.

GIVING YOU STRAIGHT FACTS ON THE NEW INSPECTOR'S LANTERN

THAT'S JUSTRITE

Model No. 2121

It's a "double-header" that provides two types of light. From the plain lens it throws a brilliant spot beam, and its new Justrite Honeycomb Lens throws a circle of clear even light 3 ft. in diameter at 8-ft. distance.

The two bulbs can be lighted separately—one for "spread-light," one for "spot" beam—each Housing has its own switch.

It can be tilted—on movable guardbase which serves as stand for lantern—to focus light at any angle desired.

It has big wood grip handle for easy carrying, space for spare bulbs.

It's winning "A" grade from railroad men everywhere—they say this new Inspector's Lantern No. 2121 is really "Justrite"! *See your supplier—today!*

JUSTRITE MANUFACTURING COMPANY
2063 N. Southport Ave., Dept. D-7, Chicago 14, Ill.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Railway Engineering and Maintenance published Monthly at Chicago, Ill., for Oct. 1, 1946.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Neal D. Howard, who, having been duly sworn according to law, deposes and says that he is the Editor of the Railway Engineering and Maintenance and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Simmons-Boardman Publishing Corp., 105 W. Adams St., Chicago, Ill.; Editor, Neal D. Howard, 105 W. Adams St., Chicago, Ill.; Managing Editor, Merwin H. Dick, 105 W. Adams St., Chicago, Ill.; Business Manager, S. Wayne Hickey, 105 W. Adams St., Chicago, Ill.

2. That the owners are: Simmons-Boardman Publishing Corporation, 30 Church Street, New York 7, N.Y.; Stockholders of 1 per cent or more of the total amount of stock are: I. R. Simmons, 15 Hillcrest Dr., Pelham Manor, N.Y.; P. A. Lee, Hopatcong, N.J.; Henry Lee, Hopatcong, N.J.; E. G. Wright, 398 N. Walnut Street, East Orange, N.J.; S. O. Dunn, 105 West Adams Street, Chicago, Ill.; C. E. Dunn, 3500 Sheridan Blvd., Chicago, Ill.; Mae E. Howson, 6922 Paxton Avenue, Chicago, Ill.; Marie J. Bleckner, Woodbury, Conn.; Ella L. Mills or Catherin S. Mills, Westfield, N.J.; Maude E. Slate, Summit, N.J.; Frederick H. Thompson, East Cleveland, Ohio; Spencer Trask & Company, 25 Broad Street, New York, N.Y. General Partners of Spencer Trask & Company are: Edwin M. Bulkley, 317 Fifth Avenue, New York, N.Y.; Acosta Nichols, Cold Spring Road, Oyster Bay, N.Y.; Cecil Barret, Bar Harbor, Me.; C. Everett Bacon, 16 Erwin Park, Montclair, N.J.; F. Malbone Blodget, 65 Patterson Ave., Greenwich, Conn.; Arthur G. Gilbert, 440 Park Avenue, New York, N.Y.; Henry S. Allen, 407 Highland Avenue, Orange, N.J.; William Kurt Beckers, 39 E. 79th Street, New York 16, N.Y.; Edwin M. Bulkley, Jr., 40 East 66th Street, New York 16, N.Y.; Charles F. Bryan, 83 Adams Street, Garden City, L.I., N.Y.; Harold H. Cook, 259 South Mountain Ave., Montclair, N.J.; Brittin C. Eustis, Old Chester Road, Essex Fells, N.J.; Anton Henry Rice, Jr., 1 Riverview Road, Irvington-on-Hudson, N.Y.; J. Streicher & Company, 2 Rector Street, New York 6, N.Y.; Partners of J. Streicher & Company are: Joseph Streicher, Ethel Streicher, and J. L. Streicher, all of 2 Rector Street, New York 6, N.Y. Ingalls & Snyder, 100 Broadway, New York, N.Y. General Partners of Ingalls & Snyder are: Warner W. Kent, Samuel H. Watts, Ralph P. Hinchman, Jr., Daniel S. Monroe, Thorvold H. Tenney, John W. Easton, Chester C. Beldran, all of 100 Broadway, New York, N.Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is..... (This information is required from daily publications only.)

N. D. HOWARD, Editor.

Sworn to and subscribed before me this 1st day of October, 1946.

[SEAL] RALPH E. WESTERMAN, Notary Public.

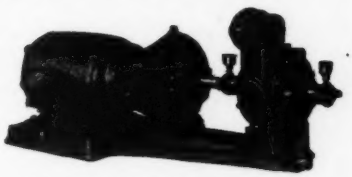
(My commission expires February 3, 1949.)

for Handling **FUEL OIL,**
LUBE OIL and Similar Liquids
Investigate

BLACKMER ROTARY PUMPS

SELF-ADJUSTING FOR WEAR

"Bucket Design" swinging vanes automatically compensate for wear. When the "buckets" finally wear out, a 20-minute replacement job restores the pump to normal capacity.



Write for Bulletin No. 307—Facts About Rotary Pumps

BLACKMER PUMP COMPANY

2140 Century Avenue — Grand Rapids 9, Michigan

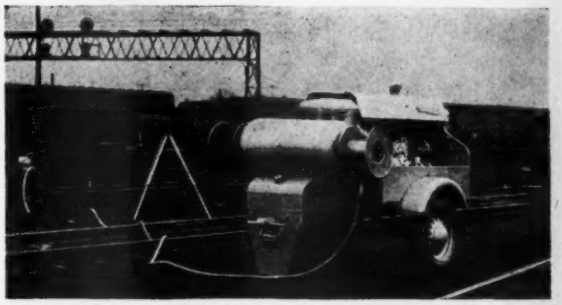
REFUELING UNITS FOR DIESEL LOCOMOTIVES

POWER PUMPS · HAND PUMPS · EZY-KLEEN STRAINERS

JAEGER "AIR PLUS" COMPRESSORS

Trailer, tractor or skid mounted

Bigger valves, slower piston speeds and micro-precision workmanship give "AIR PLUS" units remarkable fuel economy and *3 times the life of the finest modern engines*, with which they are equipped. Most advanced 2-stage, air-cooled compressors on the market; sizes 60 to 500 ft. Ask for Catalog JC-5.



THE JAEGER MACHINE CO. Main Office and Factory Columbus, Ohio

REGIONAL OFFICES: 8 E. 48th St. New York 17, N. Y. · 226 N. LaSalle St. Chicago 1, Ill. · 235-38 Martin Bldg. Birmingham 1, Ala.

PUMPS · MIXERS · LOADERS · HOISTS · PAVING MACHINERY

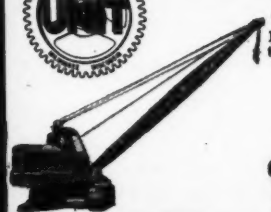
UNIT 514

Modern, ½-yard excavator for high speed digging. FULL VISION cab. Centralized controls. Convertible to ALL attachments.

UNIT CRANE & SHOVEL CORPORATION
6403 W. Burnham Street, Milwaukee 14, Wis.

1020 10-TON CRANE
Husky, crawler type crane for tough lifting jobs. Fully convertible.

357 MOBILE ½-Yd. DRAGLINE
Fast, self-propelled UNIT. Rides on rubber. Operated by one man. Powered by one engine. Fully convertible.



CONTACT FACTORY
DIRECT
For Price and Delivery

INERTOL PROTECTIVE COATINGS: THEIR PURPOSES AND USERS!

Various performance-proved grades are available. For protecting deck-slabs, bridges, viaducts (concrete or steel), against brine, salt air and water, specify INERTOL STANDARD; it also resists abrasion on foundations, abutments, retaining walls and piling. A heavier-duty material is INERTOL STANDARD *THICK;* you'll find this the best paint for resisting locomotive gases in underpasses, terminals, signaling and interlocking equipment, roundhouses and water tanks. Ask about RAMUC, the outstanding shower room enamel. You'll want to know too, about INERTOL MASTICS for membrane waterproofing and filling joints.

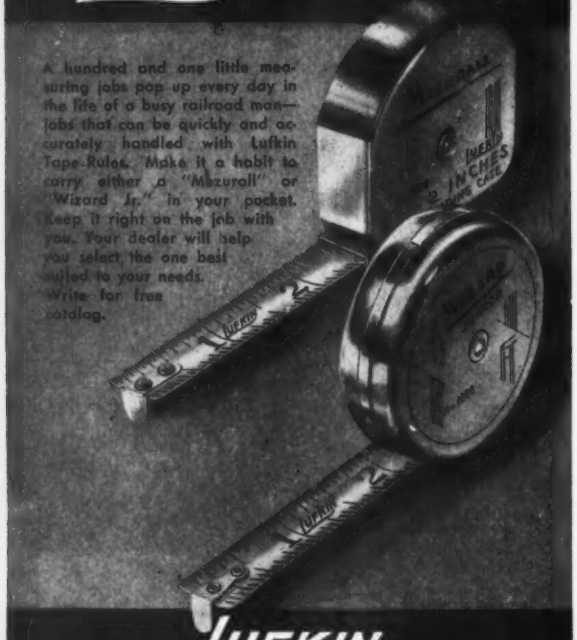
A representative list of INERTOL PRODUCT users is as follows:

C. B. & Q., C. & N. W., B. & O., C. M. St. P. & P., Reading, D. & T. S. L., C. R. I. & P., S. P., D. M. & I.

INERTOL CO., INC.

470 Frelinghuysen Ave., Newark 5, N. J.
19 South Park, San Francisco 7, Calif.

LUFKIN TAPE-RULES



A hundred and one little measuring jobs pop up every day in the life of a busy railroad man—jobs that can be quickly and accurately handled with Lufkin Tape-Rules. Make it a habit to carry either a "Mezurall" or "Wizard Jr." in your pocket. Keep it right on the job with you. Your dealer will help you select the one best suited to your needs. Write for free catalog.

LUFKIN

SAGINAW, MICHIGAN · NEW YORK CITY

TAPES · RULES · PRECISION TOOLS

HANDLE MATERIALS FASTER

ON and OFF the TRACKS

RAIL-O-ROAD KRANE KAR

For Use

ON and OFF the Tracks

The ideal Swing Boom Mobile Crane — available where you need it, when you need it.

KRANE KAR

Swing Boom Mobile Crane

1 to 10 ton cap., 9 to 37 ft. booms or telescopic booms. (Illustrated: KRANE KAR with patented Axle Carrier Attachment for transporting two wheel and axle assemblies.)

KRANE KAR speeds Maintenance of Way repairs. Handles frogs, switches, ties, guard rails, poles, rails in storage and track laying work; wheels-and-axles and trucks; timber and steel bridge members. One man operation for travel and crane service; one engine provides the power for traveling and crane service. KRANE KAR is unique by virtue of its ability to transport any load it can lift . . . and spot the load with the "live" boom which swings and tops by power. Send for fully illustrated Catalog No. 58.

USERS: AT&SF, CB&Q, BIG FOUR, B&O, PRR, CP, C&O, MP, CMSt. P&P, etc.

Agents in principal cities.

THE ORIGINAL SWING BOOM MOBILE CRANE

WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

2½, 5, AND 10 TON CAPACITIES

KRANE KAR

TRADE MARK REGISTERED

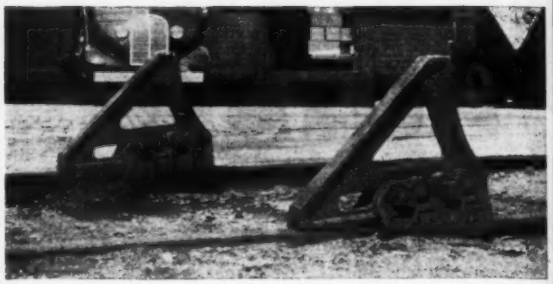
FOR RAILROADS

SILENT HOIST & CRANE CO., 884 63rd ST., BKLYN 20, N.Y.

SAVE TRACK SPACE

WITH

Q & C CAR STOPS



Q&C Car Stops are a real economy since they use so little track space and may be applied with slight labor cost. One size fits all rails used in yards and side tracks. The shock of wheels striking the stop is absorbed by the double wedge feature.

Specify Q&C Car Stops for prompt shipment.

Q AND C

THE Q AND C COMPANY

Chicago, 5, New York, 6, St. Louis, 1

Classified Advertisements

Use this section when seeking a new man, new position, or when buying or selling secondhand equipment.

CLASSIFIED ADVERTISEMENTS, $10.00 an inch, one inch deep by three inches wide, an insertion.

EMPLOYMENT ADVERTISEMENTS, 10 cents a word a month, including address, minimum charge $2.00.

Remittance must accompany each order.

Railway Engineering and Maintenance

Classified Advertising Department

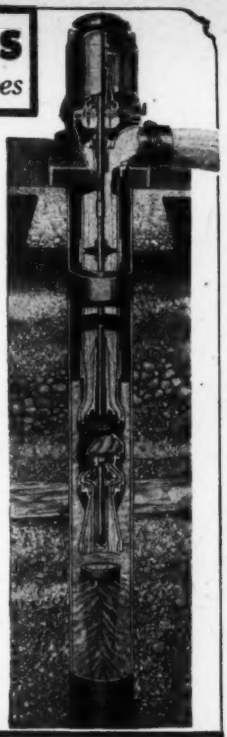
105 West Adams St., Chicago 3

FOR SALE

3—Calumet Heavy Duty, hand-operated, TRACK DRILLS, equipped with improved chuck for high speed beaded track bits. Mfd. by Crerar, Adams & Co. $30.00 each.

2—Pyle-National Co. TURBO-GENERATORS, Type K-240-5, 8 volt, 30 Amp., 24 kw., 3400 RPM, steam pressure, 300 lb. max., 9 lb. min., exhaust 0 lb., $50.00 each. Will sell entire lot for $150.00. LE-PAUL WHOLESALERS & JOBBERS, 1126 South 9th St., Springfield, Illinois.

PEERLESS PUMPS
Horizontal and Vertical Types



A COMPLETE RANGE OF SIZES AND CAPACITIES

Quality Pumps for Exacting Conditions. Efficiently serving Industrial and Municipal water requirements.

PEERLESS Vertical Deep Well Turbine Pumps assure a constant, clean water supply through such exclusive Peerless engineering features as Double Bearing–Double-Seal bowl construction; contributing to long-life, low cost pump operation and maintenance of efficiencies. Peerless Vertical Turbine Pumps are built in both oil or water lubricated types (water lubricated illustrated). Adaptable to all forms of drive.

PEERLESS PUMPS employ advanced construction principles for trouble free–full capacity pumping. Investigate them before you buy any pump.

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
Canton 6, Ohio • Quincy, Illinois • Los Angeles 31, Calif.

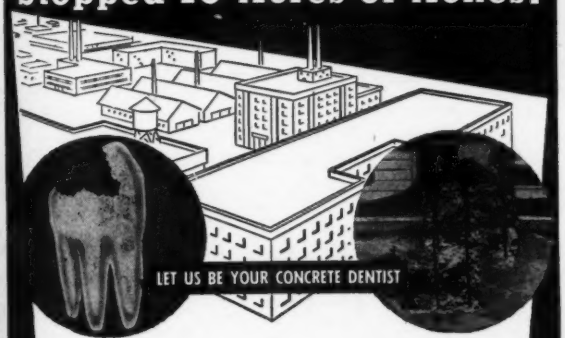
Used in sets of two; powered by two track jacks; travel 6".

New! Fast, true, positive Simplex Track Shifter saves time on track lining work. Manhours mean money. Line any weight track in any type ballast; swings, sharp and flat curves, turnouts, crossovers, ladder tracks. Ask for Bulletin TS-45.

Simplex
LEVER • SCREW • HYDRAULIC
Jacks

Templeton, Kenly & Co.
Chicago 44, Illinois

Remedial
WATERPROOFING
Stopped 10 Acres of Aches!



If "cavities" in concrete or "pits" in brick walls ruin millions of investment, let us "fill" them by RESTO-CRETE *Grouting Method*–restore them for ages. 30 years of remedial waterproofing show acres of results. Get your job done promptly–contact us.

WESTERN WATERPROOFING CO.
Syndicate Trust Building, St. Louis 1, Mo.
ATLANTA, GA. • CHARLOTTE N. C. • KANSAS CITY, MO. • SPRINGFIELD, ILL.

ON THE JOB THE YEAR 'ROUND!
...MOWER IN SUMMER
SNOW PLOW IN WINTER

Because it solves year-round maintenance-of-way problems bigger tractors cannot, the world-famous GRAVELY, with its many exclusive features, has become a "must" item with alert engineers and maintenance men the country over.

In winter, the powerful Gravely Snow Plow clears passenger and freight platforms, loading and parking spaces, etc., of snow as deep as 12 inches. Remove only four bolts to change to 42-inch Sickle Mower (illustrated) . . . cuts tallest weeds . . . or 30-inch Rotary Mower for lawns . . . Power Brush for sweeping platforms, buildings, removing light snows. Many other attachments shown in complete catalog. Write for it.

GRAVELY MOTOR PLOW & CULT. CO.
Box 1142, Dunbar, West Va.

GRAVELY
TRACTOR-MOWER
IN SERVICE SINCE 1921

You get all these features . . . and more! in I. B. LOCOMOTIVE CRANES
SAFETY CLEARANCE 14 INCHES BETWEEN ROTATING BED AND CAR BODY
MONITOR-TYPE CAB FOR 360° VISIBILITY
POSITIVE RESPONSE TO AIR-OPERATED CONTROLS
ANTI-FRICTION BEARINGS AT ALL ESSENTIAL POINTS
ROTATING AND TRAVEL FRICTION DISC CLUTCHES WITH 1-POINT ADJUSTMENT
INDUSTRIAL BROWNHOIST BUILDS BETTER CRANES
INDUSTRIAL BROWNHOIST CORP. • BAY CITY, MICH. • District Offices: New York, Philadelphia, Cleveland, Chicago • Agencies: Detroit, Birmingham, Houston, Denver, Los Angeles, San Francisco, Seattle, Vancouver, B. C., Winnipeg, Canadian Brownhoist Ltd., Montreal, Quebec.

ALPHABETICAL INDEX TO ADVERTISERS, NOVEMBER, 1946

A

Air Reduction Sales Co. 1131
American Brake Shoe Company 1168-1169
American Hoist & Derrick Co. 1137
American Lumber & Treating Company 1130
Armco Drainage & Metal Products, Inc. 1135-1232

B

Barco Manufacturing Co. 1126
Beall Tool Division, Hubbard & Co. 1224
Blackmer Pump Company 1239
Buda Company, The 1143

C

Chicago Pneumatic Tool Company 1136
Cullen-Friestedt Co. 1233

D

Dearborn Chemical Company 1125
Detzel Company, George E. 1166
Dowell Incorporated 1159
Duff-Norton Manufacturing Company, The 1165

E

Eaton Manufacturing Company 1124
Electric Tamper & Equipment Co. 1139

F

Fairbanks, Morse & Co. 1157
Fairmont Railway Motors, Inc. 1172
Food Machinery Corp. 1241

G

Gorman-Rupp Company, The 1133
Gravely Motor Plow & Cult. Co. 1241

H

Homelite Corporation 1152
Hubbard and Company 1132-1224

I

Independent Pneumatic Tool Company 1146
Industrial Brownhoist Corp. 1242
Inertol Co., Inc. 1239
Ingersoll-Rand 1154
Inland Steel Company 1226
International Harvester Company 1167
International Salt Company, Inc. 1234

J

Jaeger Machine Co., The 1239
Jordan Company, O. F. 1231
Justrite Manufacturing Company 1238

K

Koppers Company, Inc. 1153

L

Layne & Bowler, Inc. 1233
Lewis Bolt & Nut Company 1151
Link-Belt Speeder Corporation 1164
Lufkin Rule Co., The 1240

M

Maintenance Equipment Company 1161
Mall Tool Company 1234
Massey Concrete Products Company 1235
Master Vibrator Company 1235
Merritt-Chapman & Scott Corp. 1138

N

National Lead Company 1147
National Lock Washer Company, The 1123
National Water Main Cleaning Co. 1236
Nordberg Mfg. Co. 1158
Northwest Engineering Co. 1129
Northwestern Motor Company 1155

O

Oliver Corporation, The 1142
Onan & Sons, Inc., D. W. 1228
Orton Crane & Shovel Co. 1141
Oxweld Railroad Service Company, The 1174

P

P. & M. Co., The 1243
Peerless Pump Division 1241
Permutit Company, The 1140
Pittsburgh Pipe Cleaner Company 1156

Q

Q and C Company, The 1240

R

Racine Tool and Machine Co. 1237
Railroad Accessories Corporation 1171
Rails Company, The 1162
Railway Maintenance Corp. 1149
Railway Track-work Co. 1229
Ramapo-Ajax Division 1168-1169
Reed-Prentice Corp. 1238
Rust-Oleum Corporation 1227

S

Schramm Inc. 1223
Silent Hoist & Crane Co. 1240
Skilsaw, Inc. 1229
Syntron Co. 1231

T

Templeton, Kenly & Co. 1241
Texas Company, The 1225
Timber Engineering Company 1230
Timken Roller Bearing Company, The 1163

U

Union Carbon and Carbide Corporation 1174
Union Metal Manufacturing Co., The 1148
Unit Crane & Shovel Corporation 1239
Universal Concrete Pipe Co. 1236

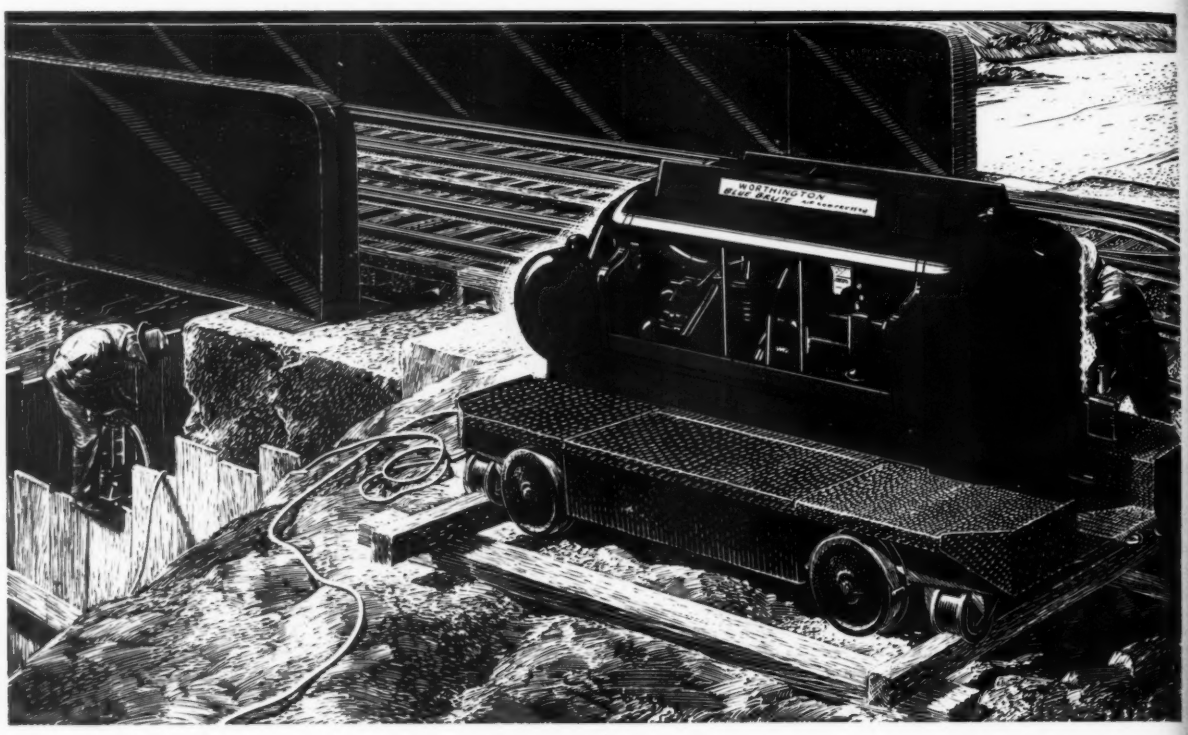
W

War Assets Administration 1128-1134-1144-1160
Warren Tool Corp. 1127
Warwood Tool Company 1237
Western Waterproofing Co. 1240
Wisconsin Motor Corporation 1232
Wood Industries, Inc., Gar 1150
Woolery Machine Company 1145
Worthington Pump and Machinery Corp. 1244

THE P. & M. CO.

CHICAGO • NEW YORK • DENVER CLEVELAND • ST. PAUL
WASHINGTON • ST. LOUIS BOSTON • SAN FRANCISCO

RIGHT... ON THE RIGHT OF WAY



Emergencies are short-lived when you tackle them with Blue Brutes. For example, at driving sheeting clean and fast around flood-weakened supports, nothing can beat these two star performers on the Worthington Track Team.

The Blue Brute Rail Car Compressor moves up on the rails and then easily off to one side, on a simple rig of skids and transverse wheels. Then you've got an unfailing source of power for as long as you want it . . . thanks to Worthington's easy-breathing Feather* Valves, three-point suspension of engine and compressor in a single housing, and full force-feed lubrication.

Hooked up to Blue Brute WSD-81 Sheeting Drivers, this two-fisted air-supply delivers fast, hard blows that get your sheeting down in record time, under all conditions.

There are Blue Brutes for greater speed and economy on every type of job. Rock Drills and Air Tools, portable gasoline or Diesel Compressors . . . champions all, at making less air do more work . . . each one ready to prove to you that *there's more worth in Worthington.*

Get more WORTH *from air with* WORTHINGTON

BUY BLUE BRUTES

*Reg. U. S. Pat. Off.

H6-10

Compressors from 60 to 500 cu. ft. capacity in mountings to suit all jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division Holyoke, Mass.